

# Consulting Engineer

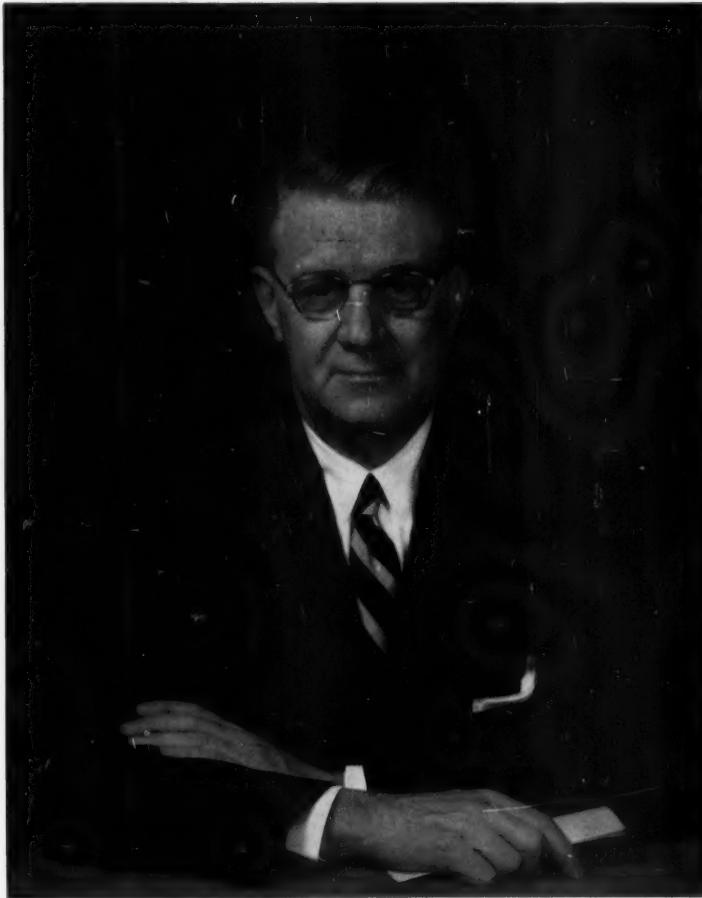


Photo by Fabian Bachrach

July 1959

JOHN CLARKESON, president of two consulting engineering firms, is one of the profession's most vocal spokesmen on the subject of private vs. public highway engineering. Because of his background (15 years with the Bureau of Public Roads and 10 years in private practice), Clarkeson can discuss both sides of the issue with a knowledge based on experience. He is a firm

*Continued on Page 14*

# Announcing

## ADVANCE FLUORESCENT LAMP BALLAST SERVICE WARRANTY POLICY

This ADVANCE FLB Service Warranty Policy protects against labor costs arising from an excessive number of failures directly attributed to self-contained components within an Advance fluorescent lamp ballast.

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Should an Advance Transformer Co. engineering analysis reveal the inoperative ballasts fall within the provisions of this program, an ADVANCE FLB Service Warranty Authorization Form will be supplied. This form must be filled out and sent to the Marketing Division of Advance Transformer Co. for approval.

When the authorization form is approved, it will be returned and new ballasts for replacement will be shipped directly to the job location without charge. After the new ballasts have been installed, the inoperative ballasts must be returned directly to Advance Transformer Co. for complete analysis and final approval.

Invoice for allowance must be referred to the Marketing Division, Advance Transformer Co., 2950 North Western Avenue, Chicago 18, Illinois. All authorized allowances will be paid by Advance Transformer Co.

*Louis Duncan*  
PRESIDENT



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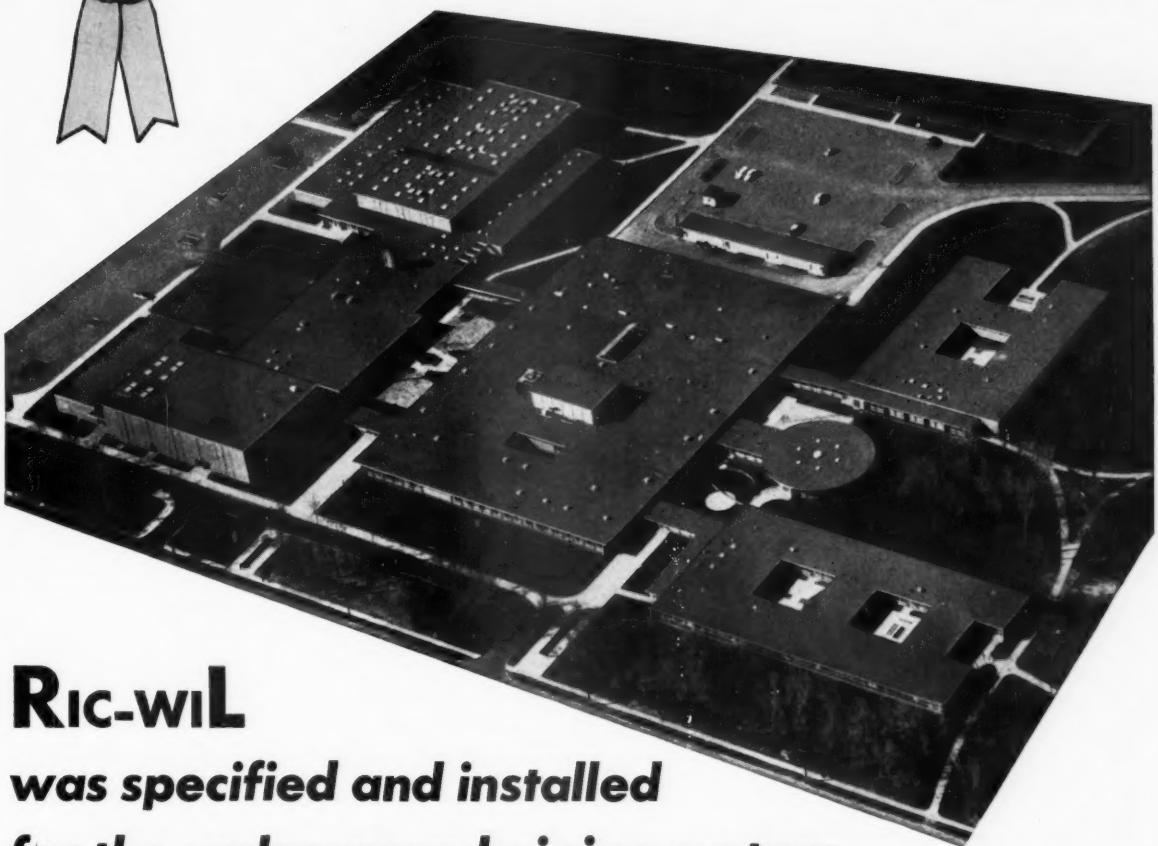
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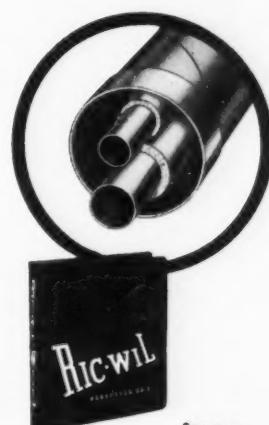
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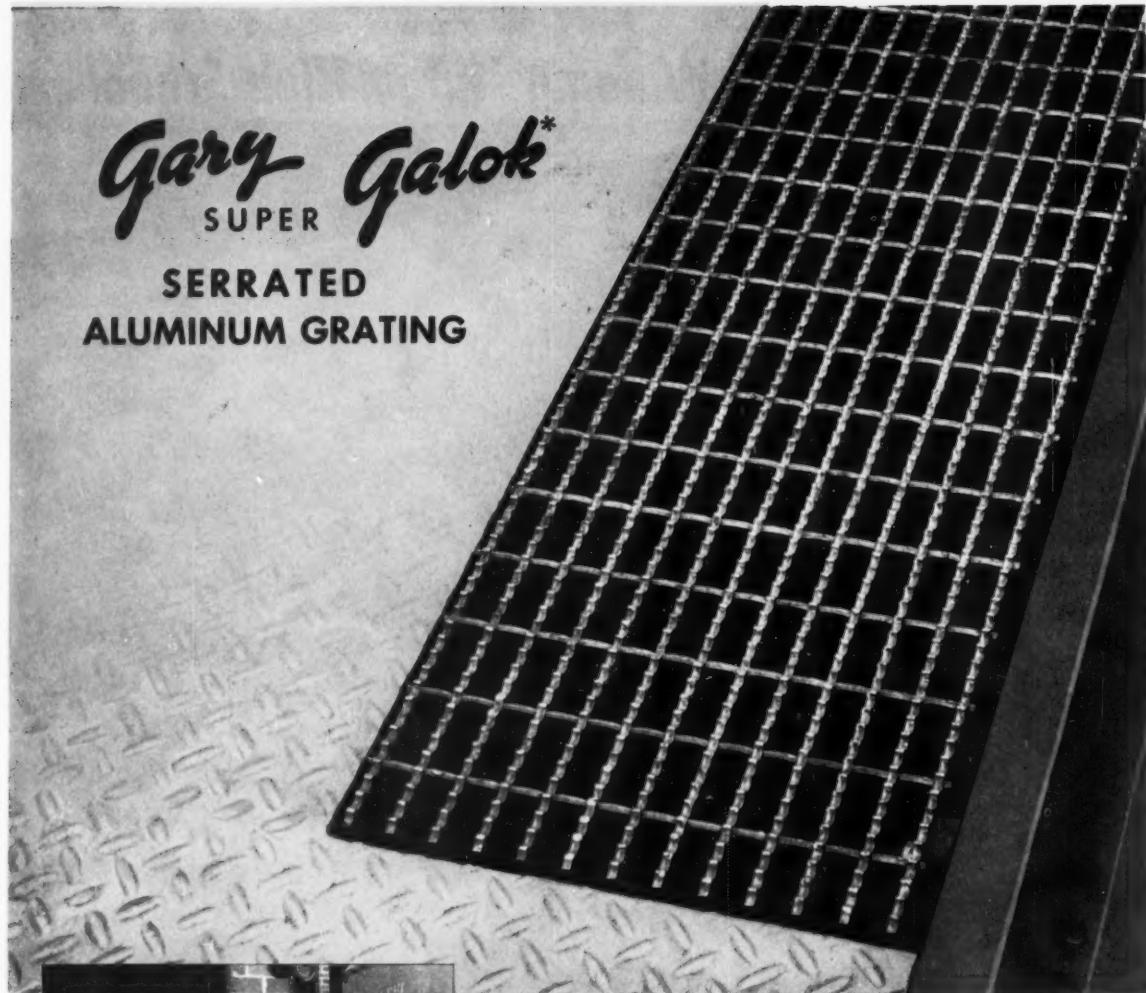
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Wayne near Pleasant Street  
Saint Joseph, Michigan

July 1959 • VOLUME XIII • NUMBER I

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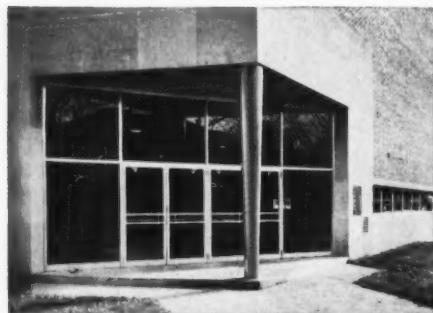
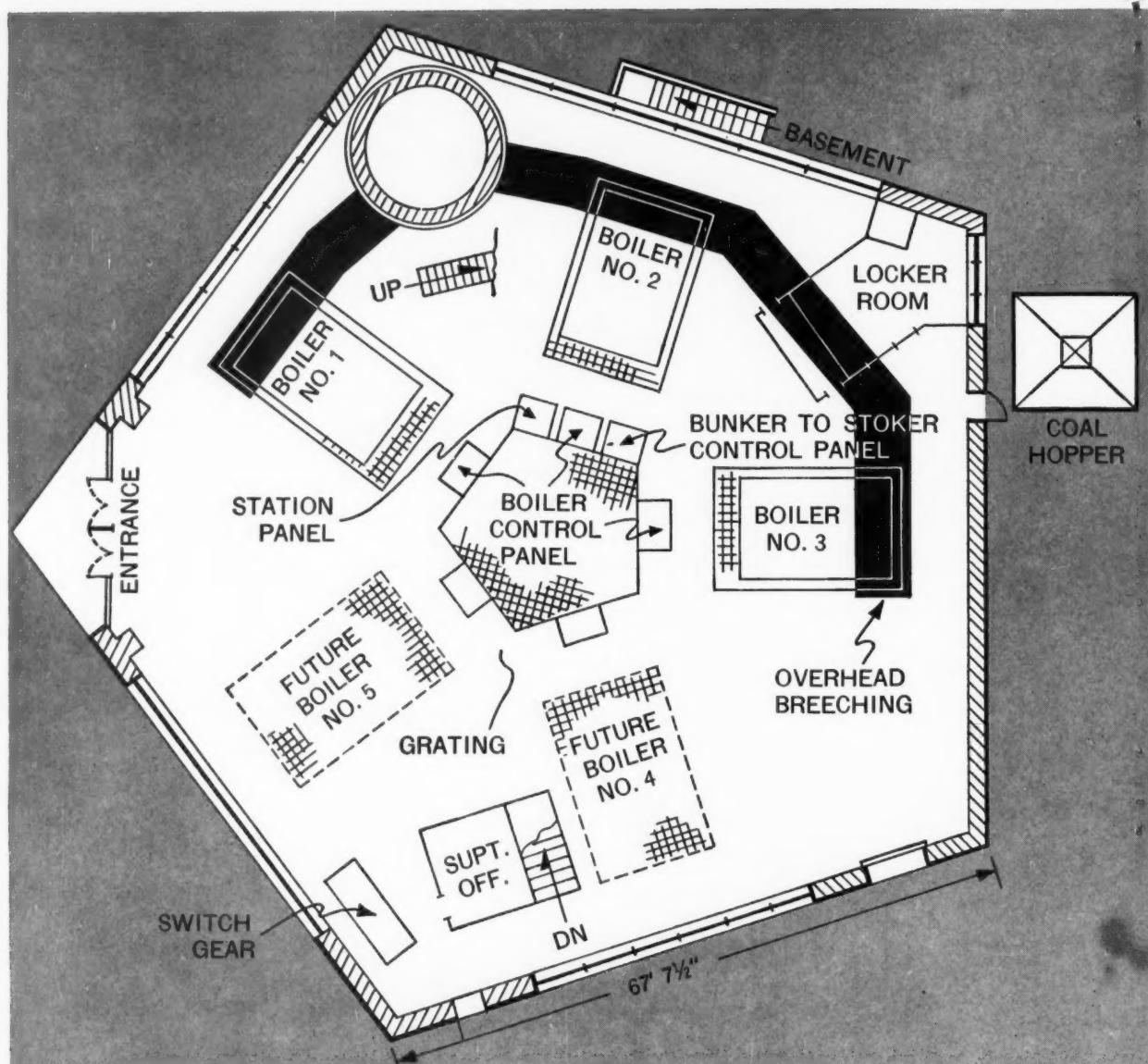
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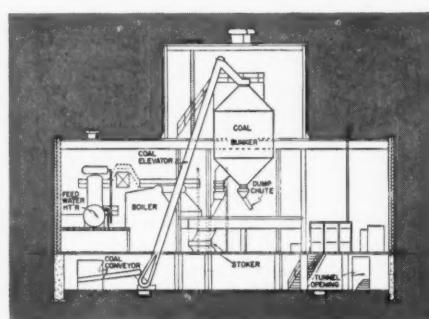


CONSULTING ENGINEER is published monthly by Consulting Engineer Publishing Company at 217 Wayne Street, Saint Joseph, Michigan. Price 1 year \$10.00; foreign \$15.00; single copy \$1.00. Accepted as Controlled Circulation Publication at Saint Joseph, Michigan. Copyright 1959, Consulting Engineer Publishing Company.





Entrance to unusual "little Pentagon" structure. This shape gives maximum space utilization and allows one-man central control of all boilers. Construction provides comfortably for three 31,000 lb/hr boilers and allows for two similar units in the future, within 7,000 sq. ft.



Elevation shows how coal moves from incoming conveyor by 25 ton/hr. Stephens-Adamson Redler elevator to overhead bunker (capacity 125 tons). Coal feeds from here to scales, then directly into stokers. Bunker and scales by Beaumont Birch Co.



Coal is brought in by rail and unloaded into track hopper. From here, a Stephens - Adamson conveyor carries the coal into the plant and internal coal handling system.

# Hospital cures fuel ills with "little Pentagon"

## Richmond State Hospital burns coal for economy and availability in modern pentagonal power plant

After a power system failure at the Richmond State Hospital, Richmond, Ind., the administration conducted an engineering survey of its steam-generating operation. Over-age equipment indicated the need for entirely new facilities. The shape of the boiler room site prompted the unconventional pentagonal installation for best possible adaptation of space to present and future needs. *Economy and availability* dictated the choice of coal as the fuel.

Today a new power plant—designed by Fleck, Quebe and Reid, Indianapolis, with F. B. Morse, of Purdue University—burns coal in a completely modern, automatic operation. The outstanding features of this compact installation are its high combustion efficiency, minimum manpower requirements and continuing ease of maintenance.

### Coal is lowest cost fuel

Today, when the annual cost of fuel often equals the original cost of the boilers, you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burn-

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All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

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Shown are three Henry Vogt boilers, fed by Laclede chain grate stokers, with individual control panels. Controls are pneumatic type, by Copes Vulcan. From boilers, ashes are moved pneumatically by United Conveyor Ash handling system to silo for disposal.

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Gentlemen—please send me:

GS-1 (low-pressure heating plant, screw-type underfeed stoker);  GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker);  
 GS-3 (automatic package boiler for heating and process plants).  Case histories on larger plants.

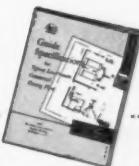
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*Six steps to better curbing with Penn Ventilator*

## SELF-FLASHING EXTRUDED ALUMINUM SONOTROL CURB

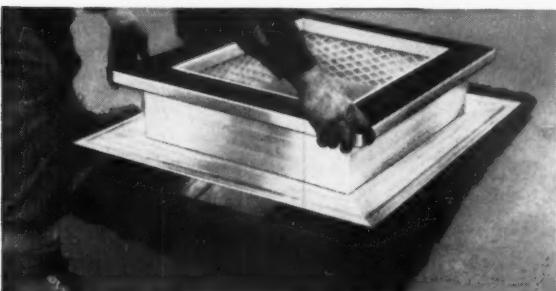
That's all there is to it. It's the biggest advance yet in roofing curbs. Eliminates errors in the field . . . no more coordinating, flashing and waiting. You just place your order when roof opening dimensions are set . . . and the curb is delivered when you need it. Penn Ventilator is the single source of responsibility. You get ventilator, curb and damper . . . and everything fits.

The self-flashing feature keeps units low to the roof and is used and approved by leading roofing material manufacturers. All-aluminum construction of the new Sonotrol Curb reduces roof loading, saves time, makes it easy to handle. "I" beam design adds to its sturdiness. It's non-porous and weathertight, includes an integral neoprene-rubber gasket. Special acoustical insulated lining provides for sound attenuation, and eliminates condensation.

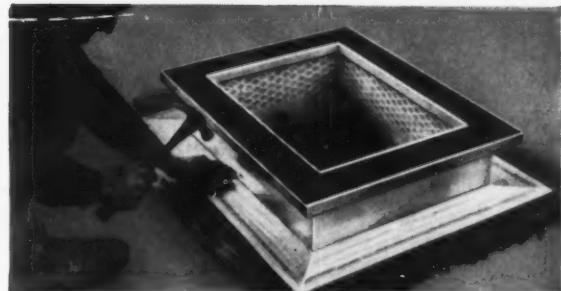
Get complete details on this revolutionary self-flashing Sonotrol Curb that actually costs no more than the "hit-or-miss" method of field construction. Your nearby Penn Ventilator man has a sample section to show you.



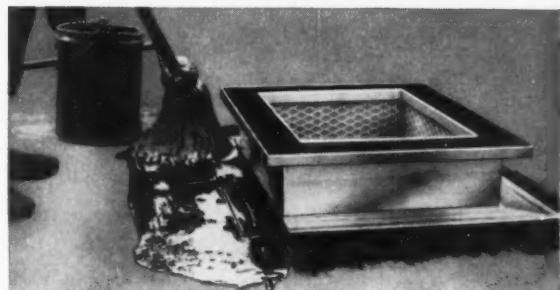
1. Butter 12" wide bed of plastic roofing cement around roof opening.



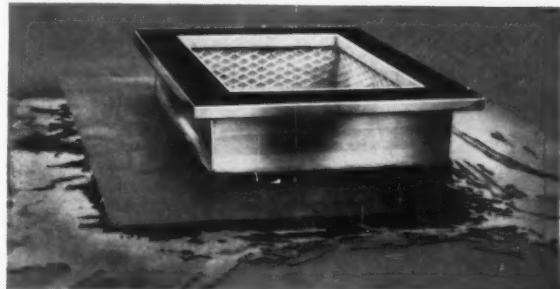
2. Set curb in roofing cement.



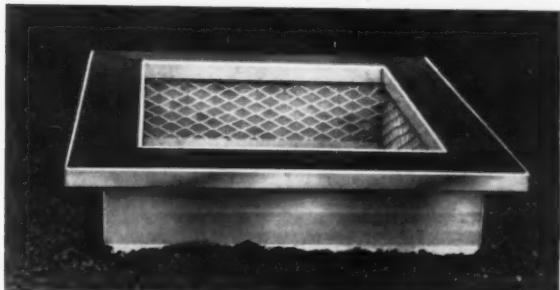
3. Fasten curb to roof deck.



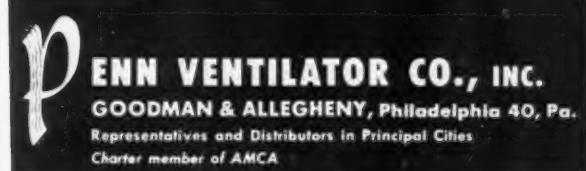
4. Prime for strip flashing.



5. Strip flash and finish roofing around curb.



6. Curb is now ready for ventilator.



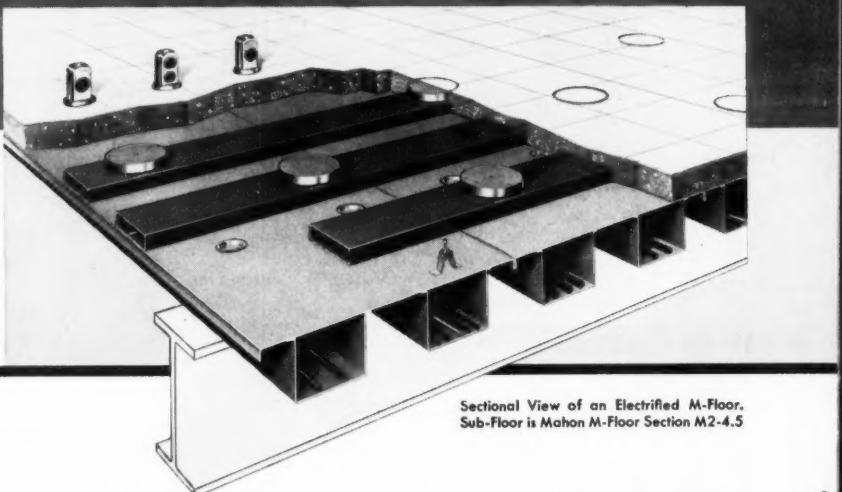
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Consulting Engineer: J. Robert Carlton  
Structural Engineer: Torrence Druline & Associates  
General Contractor: Graham Brothers



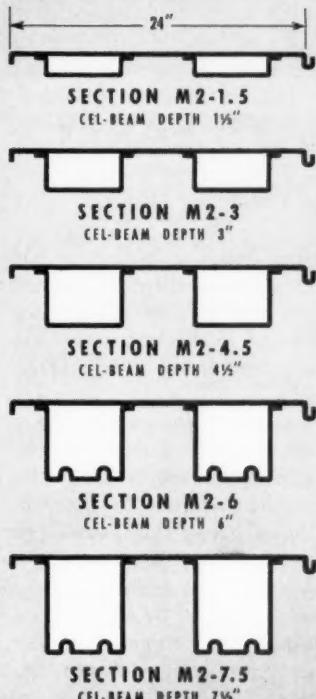
Sectional View of an Electrified M-Floor.  
Sub-Floor is Mahon M-Floor Section M2-4.5

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- Acoustical Metal Ceilings
- Structural Steel—Fabrication and Erection
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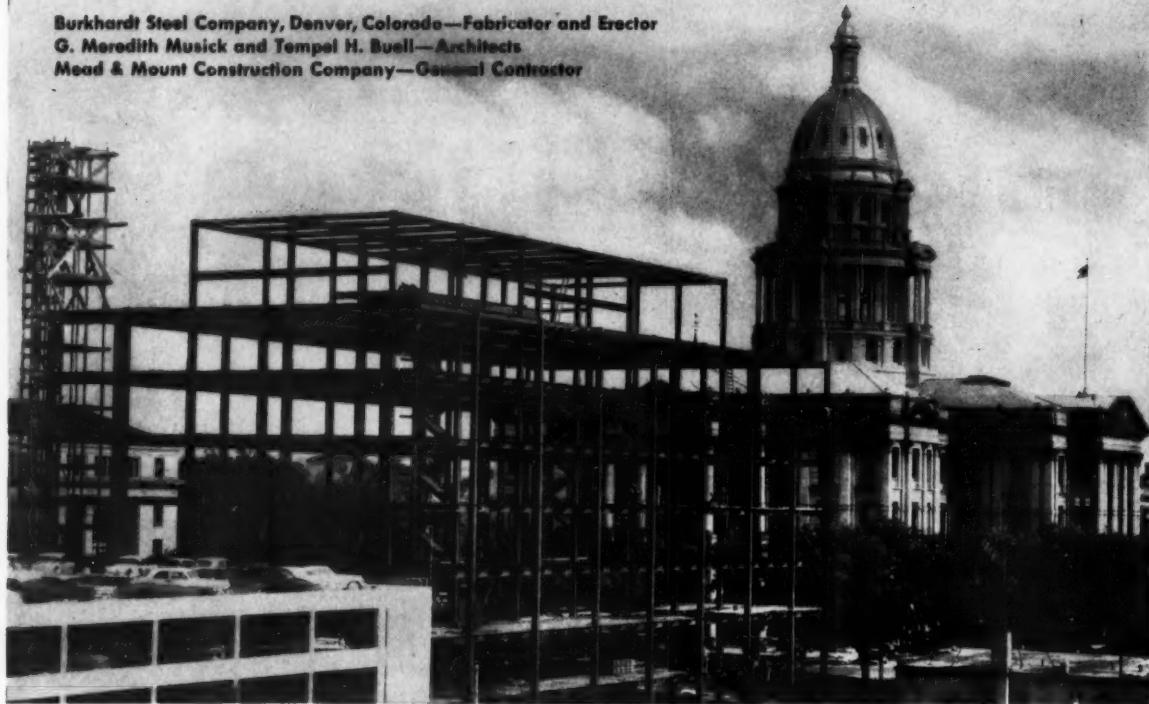
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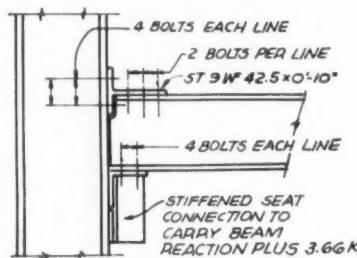
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# MAHON

Burkhardt Steel Company, Denver, Colorado—Fabricator and Erector  
G. Meredith Musick and Tempel H. Buell—Architects  
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## FIELD ERECTION COMPLETED 12 DAYS EARLY ... WITH WELDED CONNECTIONS



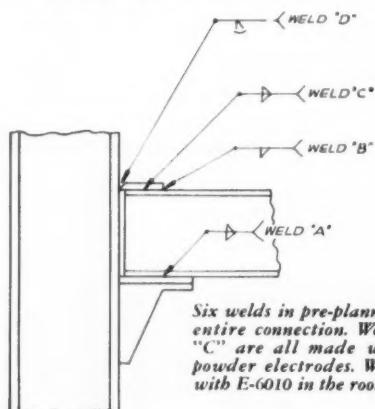
Typical wind connection before redesign, required 22 field bolts costing 24 cents each and, at least, two drilled holes for each bolt.

The new seven story State Services Building in Denver was originally designed for welded shop fabrication and bolted field erection. Conversion to welded field erection cut material costs 2.5% while both shop labor and field labor costs were substantially reduced. Erection was completed 12 days ahead of schedule.

Material savings were made possible by the elimination of 22 bolts, cover plates and a stiffened seat for each connection. In contrast, the simple welded connection required only six field welds—all made in the downhand position. The seat was a simple half-section of a wide beam flange shop-welded to the column.

Elimination of the more complicated seat and drilling for bolt holes reduced shop labor costs.

All field connections were designed for downhand welding to permit use of faster, easier operating, Lincoln Jetweld iron powder electrodes.

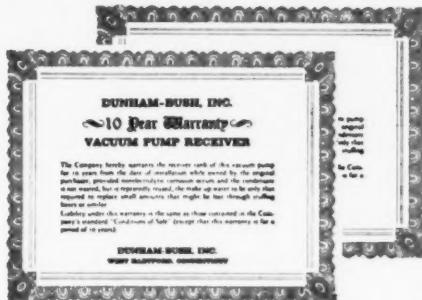


THE LINCOLN ELECTRIC COMPANY  
DEPT. 5815, CLEVELAND 17, OHIO

The World's Largest Manufacturer of Arc Welding Equipment

# Dunham-Bush Issues 10 Year Pump Receiver Warranties—Reaffirms Continuance of Quality Product Lines

Recognizing a general industry trend to put price in a paramount position and inherent dangers of quality control in such a concept, Dunham-Bush has taken this step.

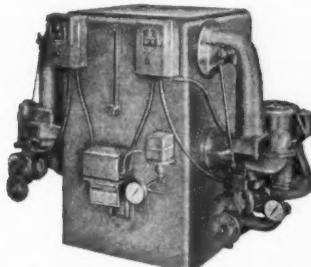


Pioneering in the interests of specifier, installer and owner, Dunham-Bush has issued a ten year warranty on their vacuum pump and condensate pump receivers. This warranty is a clear cut expression of the manufacturer's confidence in their product performance and willingness to back up this expression of confidence with a written warranty.

The Dunham-Bush ten year warranty reads as follows: "The Company hereby warrants the receiver tank of this vacuum (condensate) pump for ten years from the date of installation while owned by the original purchaser, provided nonelectrolytic corrosion occurs and the condensate is not wasted, but is repeatedly reused, the make-up water to be only that required to replace small amounts that might be lost through stuffing boxes or similar.

Liability under this warranty is the same as those contained in the Company's standard 'Condition of Sale' (except that this warranty is for a period of ten years)."

Attesting to an integrity of manufacturing that has guided the Dunham-Bush product lines since 1903, this latest step insures continued quality with today's modern production and pricing methods.



The Dunham-Bush vacuum and condensate pumps with copper bearing steel receivers, offer many outstanding features for dependable and economical operation.

## A Complete Dunham-Bush Vacuum Pump Line

Type VR, Model C2. Single Unit. 2500 through 20,000 EDR.

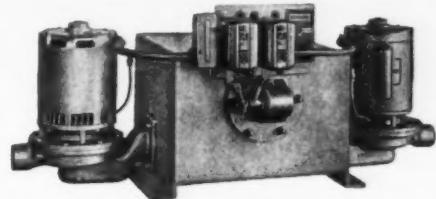
Type VRD, Model C2. Duplex Unit. 2500 through 20,000 EDR.

Type VR, Model B2. Single Unit. 25,000 through 65,000 EDR.

Type VRD, Model B2. Duplex Unit. 25,000 through 65,000 EDR.

## How Simple Two Cycle Operation Works

One simple moving element—the pump impeller—(1) forces water through the exhauster, creating a vacuum for constant circulation of steam, vapor and condensate through the heating system piping, and (2) creates a positive pressure for delivering condensate to the low pressure boiler.



## Positive Condensate Removal

Dunham-Bush pumps efficiently handle hot condensate at above normal rates assuring dependable operation under all conditions. Efficiency and capacity are not dependent on close tolerance of parts. This means continuous, trouble-free operation. On all duplex pumps, automatic stand-by service is standard. Fuel is saved by returning hot condensate to boilers rather than wasting to sewers. This reduces amount of make-up water and minimizes difficulties from boiler incrustation and system corrosion.

## 2,000 Through 50,000 EDR Range

Dunham-Bush Type CHV pumps are manufactured in capacities of 2,000 through 20,000 EDR with discharge pressures at 15 and 20 pounds.

Type CH pumps provide capacities 2,000 through 50,000 EDR with discharge pressures from 10 through 70 pounds and are designed for heavy-duty applications.

## Product Data Available

File 1401 B gives complete Dunham-Bush vacuum pump specifications and data. Form 1403 details the condensate pumps. Sample Warranty available for inspection. Request direct from manufacturer.

**Dunham-Bush, Inc.**

AIR CONDITIONING, REFRIGERATION,  
HEATING PRODUCTS AND ACCESSORIES

WEST HARTFORD 10, CONNECTICUT

## John Clarkeson

*-Starts on front cover*

believer in state highway department-private engineering firm teamwork.

"Everyone seemed much upset to learn that 8 percent of the medical profession is in public employment," Clarkeson commented. "Yet, when I went into road building, 80 percent of this country's civil engineers were on public payrolls. I do not know what the percentage is today, but it must be almost 50 percent and present public policies can raise the figure to 80 percent again. Still, I seldom hear a voice raised in protest, or even a public discussion of this trend."

"The Federal policy as regards the highway field, contrary to the Hoover Commission recommendations and the President's position, favors public engineering. This is not wholly apparent, since the regulations admit the use of private firms when necessary, but in its daily dealings with the states, the Bureau of Public Roads is stressing the undesirability of private engineering groups being employed. In spite of the fact that the present private engineering groups were organized or expanded to accommodate the demands of the road program, many of the administrators now wish to leave this private enterprise group to wither on the vine."

### Private Practice is Economical

Why should highway departments use consulting engineers instead of expanding their own staff?

Clarkeson quoted one of his favorite references, the Hoover Commission Task Force Report, to explain his first reason—economy. "The cost to the government of its design and construction activities is abnormally high and out of line with the cost of similar work in private industry. This results from having so many offices independently engaged in architectural and engineering work; from over-staffed, permanently retained technical groups; from the many different standards and management practices; and from the absence of operating data which would provide a means of comparing the effectiveness of the numerous Federal design and engineering organizations.

"Private architect-engineer and construction organizations are geared to a broad base of diversified work and to the efficiency and flexibility of large-scale, competitive construction activities. In times of peace and of national emergency, they have effectively and efficiently met the demands of the government for Federal construction projects, as well as the demands of industry for private construction.

"By contracting to private architect-engineer and construction organizations all phases of design and

construction, relatively small supervisory engineering organizations in the executive agencies could furnish the preliminary study, preplanning, and budgeting, and the supervisory management and control essential for all government projects, without maintaining through periods of fluctuating demands the present costly overhead for complete engineering and construction staffs. With minor exceptions, the Atomic Energy Commission has been operating under such a program. If other Federal agencies could attain the operating efficiency of the AEC, the savings to the government in just the cost of design and supervision of construction, on the basis of present volume of business, would be more than \$100 million annually."

In spite of this strong support for private practice, consulting engineers as a group have shown little interest in fighting for the adoption of the Hoover Report. Clarkeson suggests that immediate action along these lines is vital to the future of the profession.

"I have worked closely for many years with a number of state highway departments," observed Clarkeson. "I would say these departments generally have design costs of 6 to 8 percent, plus supervision costs of 6 to 7 percent. A consulting engineer could do similar work at 4 to 4½ percent for design, plus 3½ to 5 percent for supervision."

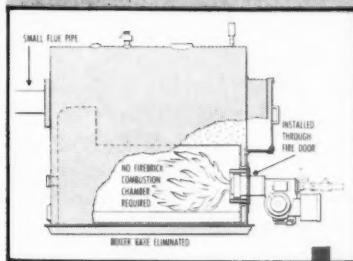
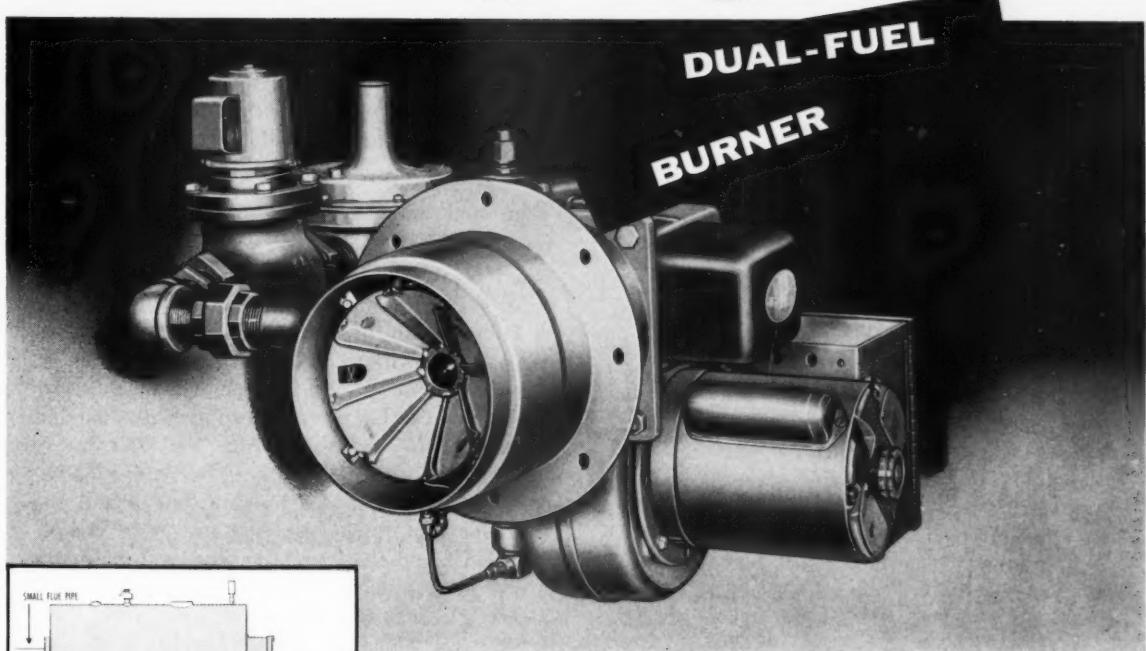
### Other Benefits From Private Practice

Speed plus improved design and construction coordination were given as other important reasons for using the services of a consulting engineer. Clarkeson pointed out that, "state agencies should realize that it is to the benefit of the consulting engineer to have a job run fast and well. The consultant benefits because he makes more by going on to another project as quickly as possible. The contractor likes it because it means he gets paid with less delay. And of course, the client benefits."

Another advantage in using the services of consultants is that the engineers in private practice take ideas across state lines. "Many states are quite provincial," said Clarkeson. "Working with the same people day in and day out, they tend to develop design habits. Daily contact with a consulting engineer, who has worked with many states, offers fresh and often vastly improved methods of design.

"The average civil engineering firm today is a greatly expanded organization as a direct result of the demands placed upon the civil engineering profession by highway administrators," continued Clarkeson. "When the 1955 and 1956 hearings for the Federal-Aid Highway Act were held in Congress, the fact that these private firms existed and could be expanded was one of the points of testimony by highway officials and others that the de-

# NEW PETRO PowerBlast®



**Needs no firebox refractory**

**Burns clean in less than 10 seconds**

**No high stack**

**Greatly reduces standby heat loss**

**Costs much less to install**

## For steel firebox boilers

Needs no firebox refractory!

Until now, oil firing has required refractory lining in the firebox to "support combustion," which simply means that an old-style burner does not burn the fuel completely without the reflected heat from the hot bricks. Burners requiring these combustion chambers produce smoke during the starting period. Accepted industry standards allow up to 15 minutes warm up. Incomplete combustion is evidenced by soot deposits on heating surfaces and is a source of atmospheric pollution.

The notable fact about this new Petro PowerBlast firing system is that the burner itself achieves complete combustion immediately with either gas or oil, without depending on reflected heat. It burns clean in a cold firebox in less than ten seconds.

Since there is no heavy brickwork to store heat (and due also to the burner design) standby heat loss is reduced to practically nothing. As every heating man knows, this eliminates the source of a very substantial fuel waste.

We have described but one feature of the remarkable new Petro PowerBlast burner. There are many others. Mail coupon for further information.

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mands of that Act could be met in terms of manpower availability.

"This does not in itself give the private engineer the right to a living, but if he can perform this work as well or better than government employees, he should, on the basis of the record, be given the opportunity to do so. Under present policies and attitudes, the market for private enterprise in the highway engineering field is shrinking."

#### Private Practice Under Attack

"It is a matter of considerable perplexity to me," Clarkeson said, "that the U.S. Chamber of Commerce should unwittingly be an accessory to the sponsors of public engineering through its brochure *The Businessmen's Guide to the Road Program*. I also cannot understand the attitude of the Automotive Safety Foundation, as expressed in its report to the Pennsylvania Highway Department. This Foundation is supported by private enterprise, yet its policies are against the engineer in private practice. No doubt they, or others, can find minor abuses in any system of engineering management, but I should think they would seek to remove the abuses rather than the system."

Clarkeson, who has spoken on behalf of the consulting engineer on numerous occasions, added that "consulting engineers are treated like stepchildren

because they act like stepchildren. Contractors, on the other hand, are shown considerable governmental respect when they have a legitimate complaint. Why? Because the contractors have a strong organization with a record of clarifying contract requirements in a way that is fair to both sides of the contract.

"For engineers, too, someone has to clarify the rules of the road. Through sound professional organizations, we must establish a high level of professional conscience. Equitable contract interpretation is basic."

#### Education and Experience

Clarkeson attended Union College in Schenectady where he won a Charles P. Steinmetz scholarship. After graduation he was employed by the Bureau of Public Roads, having worked summers at drafting and surveying.

After several years on routine Bureau of Public Roads jobs, Clarkeson was placed in charge of labor relations for an eight-state area. This was during the mid-'30s, when labor unions were first beginning to organize in the building trades and the first minimum wage laws had just been passed. Also, WPA and PWA projects presented their own special labor problems.

During labor conferences in New York City, Clarkeson first met Robert Moses, New York City Construction Coordinator. He credits Moses, during this period, with fostering the growth of the consulting engineer in highway design. Moses was pushing the Metropolitan parkway program to make maximum use of available Federal funds. The public agencies advised Moses they could not complete plans fast enough to meet the necessary deadlines, with which they had to comply or lose the Federal funds. Moses found several small consultants who were able to do the design work. Although it took a tremendous effort on the part of the consultants, they met the crises.

In 1935, Clarkeson was placed in charge of promoting, establishing, and operating the nation's first comprehensive highway planning surveys. These surveys, which included a complete mapping program, still are used throughout the country.

#### War Time Service

During the war, Clarkeson was responsible for the BPR Fairbanks office for the Alaska-Canada Highway. When he went to Alaska, the highway was merely forest. His office was in charge of logistics and supply for the road crews, hospitals, and other highway personnel.

"We had to purchase, rehabilitate, and ship everything," he said, "including a large amount of earthmoving equipment we converted from placer

just ONE heavy duty unit services up to 19 MACHINES

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# New Emphasis on Ion Exchangers In Paper Making

New *Nalcite* resins broaden water treatment scope; make demineralized water practical in wider range of paper mill applications

Bringing ion exchange—and especially demineralization—within the practical range of paper mill water treatment cost, handling and volume requirements is the job now being done with Nalcite Ion Exchange Resins for conditioning a variety of mill waters. Their practicality for these jobs is putting new emphasis on demineralization for producing high quality water at reasonable cost.

New Nalcite resins are new only in that they have recently been released for industry-wide use.

**Nalcite HCR-W** . . . pretested for four years . . . is a proven cation exchanger of superior physical stability, and is the latest addition to the series of high performance Nalcite resins.

**Nalcite SBR-P** . . . in slightly more than 3 years since its introduction this highly porous, strong base anion exchanger has surpassed performance expectations.

## Better Water = Better Paper

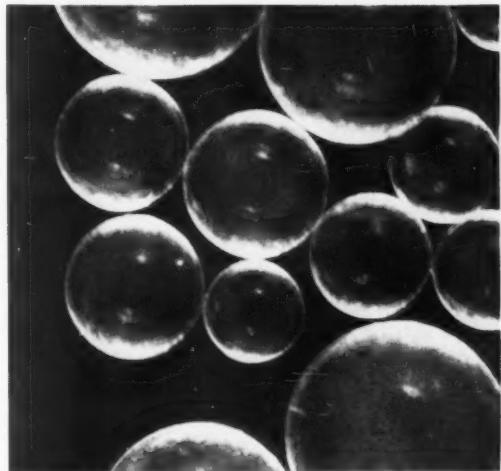
Demineralized water for *process chemicals preparation* provides a solid base for making uniform solutions which will perform predictably. Other important examples are *aqueous coating solutions* and *dilution water for making electrical condenser paper*. Nalcite-demineralized water, having extremely high electrical resistance, goes far toward helping produce the dielectric strength in finished condenser paper that users want, but not always have been able to obtain.

## Steam Production

Demineralized boiler feedwater solves a multitude of steam generation operating and maintenance problems at once. Use of Nalcite Ion Exchangers in modern demineralizing equipment is the surest source of top quality feedwater . . . water that helps produce steam at lowest possible cost.

## Higher Physical Stability is Key To New High in Performance

Nalcite HCR-W cation exchanger is teamed with Nalcite SBR-P anion exchanger for top demineralization.



Nalcite HCR-W under the photomicroscope looks like no other ion exchange resin: clear, perfectly-formed microspheres, stress-free, crack-free, virtually breakage proof in any known ion exchanger service.

alizer performance—in either multiple bed or mixed bed systems. Stress relieved HCR-W bead microspheres are virtually shatterproof. Similar stability of SBR-P assures low pressure losses—and pressure drop stays at design figures since there are no fines to fill spaces between beads or clog strainers, distributors or controls. Backwashing and regeneration are quicker, more efficient with Nalcite exchanger beds.

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mines. Often we practically manufactured the equipment. We would cut a truck in two for air shipment. Or maybe we would build a truck from the usable parts of three or four derelicts."

After the Alaskan project was under control, Clarkeson joined the Navy Civil Engineering Corps. He was assigned as engineer-officer in charge of a Seabees construction unit expanding the Argentina, Newfoundland air base. He also was involved in the building of wharfs, docks, and drydocks.

Next, Clarkeson was transferred to the Amphibs, U.D. Team 9, and became a member of one of the first American frog men groups. Unlike the glamorized versions of later years, these men operated only with a knife, swim trunks, and dynamite (plus swim fins if they could get them). The men were chosen because they could handle explosives, not because they were good swimmers.

#### Back to Civilian Life

At the end of the war, Clarkeson was sent to Manila to make a survey of the damage done to roads and bridges in the Philippines. Following this tour of duty, he returned to the Bureau of Public Roads, where he was acting divisional engineer for construction, maintenance, and design for an eight-state area with headquarters in Albany. It was during this time that he coauthored (with Arthur

G. Bruce) *Highway Design and Construction*. This book, used by 125 schools, is being revised.

#### Into Private Practice

In October 1949, Clarkeson opened his own consulting office in Reading, Massachusetts. His first client was the Massachusetts Department of Public Works, which wanted assistance in its accelerated highway program. At that time the DPW was able to handle \$10 million worth of projects a year. Two years later, the Massachusetts DPW was geared for \$100 million a year.

Until 1952, Clarkeson had no staff of his own, but that year he set up the Clarkeson Engineering Company, in Boston. Three years later he opened his Albany and Washington branch offices. He now has 225 employees and has handled the design of projects valued at more than \$500 million.

One of Clarkeson's more unusual projects was a \$6-million interchange for the Massachusetts Turnpike. From the day he was given the preliminary data, he had 11 months to complete the project. He beat the deadline by two weeks.

"The Turnpike Authority assisted us by negotiating with the contractor," he said, "thus, eliminating a 30 to 90 day bid period. We completed the general plans within six weeks. Then we had the contractor working right behind us." To complicate matters, the project was under way during the steel storage, and sometimes the whole program hinged on the schedule of the steel supplier.

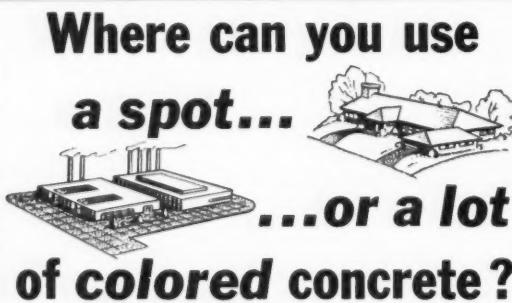
In addition to a large number of New England highway projects, Clarkeson's organization also has done feasibility studies and design reports on the New York Avenue Freeway and the location of U.S. Route 240, both in Washington, D.C., and on location and design of Interstate Route 93, running from North Woodstock through Franconia Notch, New Hampshire.

#### Professional Activities

Clarkeson, registered in nine states, has not neglected professional activities. A director of the consulting engineers division and a member of the executive board of the American Road Builders Association, he also is a member of the American Society of Civil Engineers, the Boston Society of Civil Engineers, the American Society for Testing Materials, the American Concrete Institute, the Highway Research Board, the Institute of Traffic Engineers, the New England Transit Club, the Massachusetts Building Congress, the Massachusetts Highway Association, and the Association of State Highway Officials of the North Atlantic States.

"My firm also plans to become a charter member of the Consulting Engineers Council when a Massachusetts group is formed," he added. ▲▲

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a spot...  
...or a lot  
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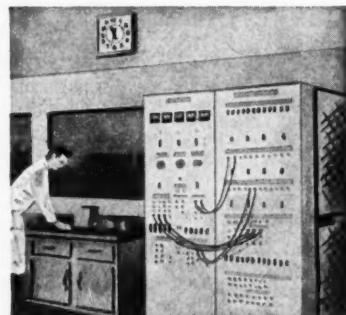
**Clock and Program Systems**—Flexchron® systems, featuring synchronous motor drive—full 12-hour resetting of classroom and corridor clocks automatically. Famous "Memory Tape" program control with its unequalled flexibility in programming. Bell Control Boards... reliable Minute Impulse clock systems.



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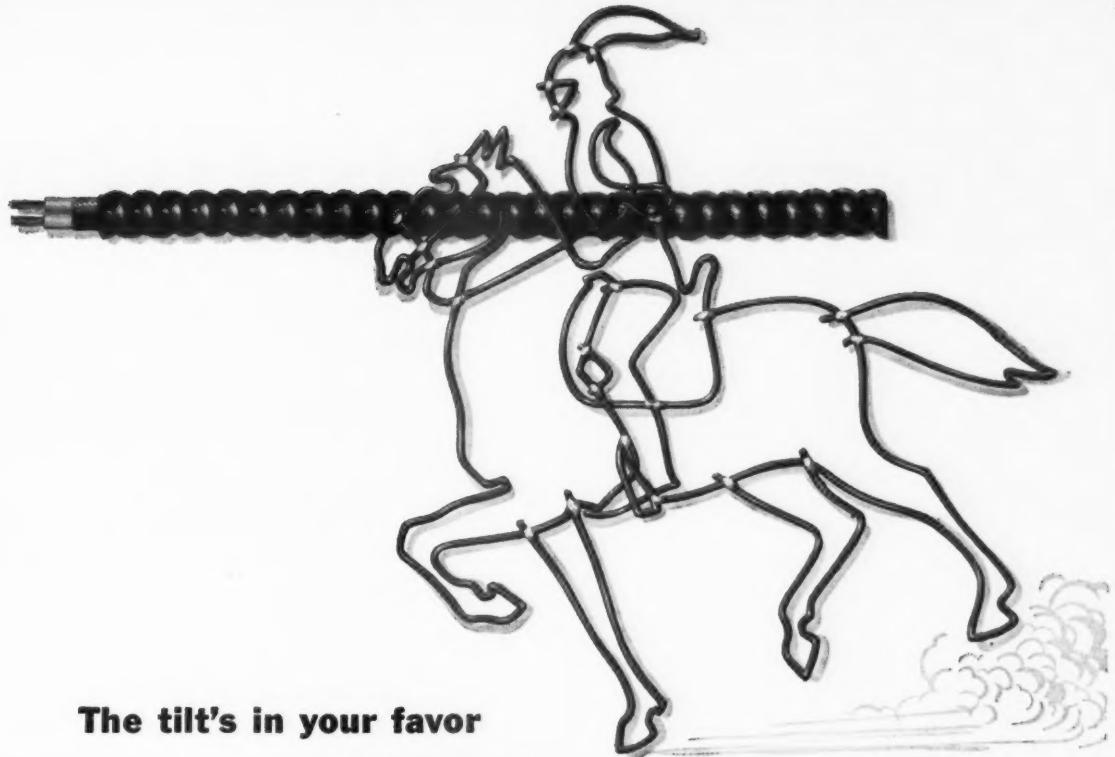
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Clock and  
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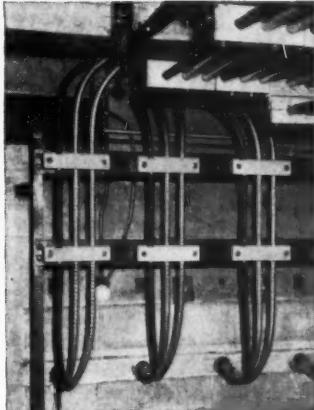
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**the new color  
coded armor**



New, color-coded Simplex aluminum CONDEX interlocked armored cables permit maximum efficiency and flexibility in plant layout planning, and they make installation and maintenance easy.

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in vertical transportation  
for multi-floor  
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Albert Kahn & Associates, Architects

In the finest buildings

# elevonics

Our creative scientists and engineers are concentrating their energies in a special field of science . . . the application of electronic devices for betterment of elevator design and performance.

We call this special science *Elevonics*. And we are pleased to tell you it has already made possible significant new progress in elevator technology.

For example: Haughton Elevators that **think for themselves** are now operational in buildings coast-to-coast. These elevators combine the economy and efficiency of true automated (operatorless) control with swiftness, comfort and safety. They are motivated by an amazing "electronic brain" that anticipates elevator service needs on every floor of a building at every

moment of the day or night . . . and dispatches elevators at the proper time and in proper sequence to meet traffic needs exactly.

And, while new Haughton operatorless elevators do a complex job in meeting a building's particular traffic needs, their simplicity of design and operation provides complete reliability and substantial savings in operating costs.

If you are interested in upgrading elevator service, and cutting elevator costs, call on us. The constant quest for new advancements in elevator technology by the imaginative minds of our scientists and engineers is solid assurance we can best meet your elevator design, installation and maintenance needs.



10 Lafayette Square Building, Buffalo, New York — Emery Roth & Sons, Architects



Libbey-Owens-Ford Building, Toledo, Ohio — Skidmore, Owings and Merrill, Architects



Universal Building, Washington, D.C. — Le Roy Werner, Architect

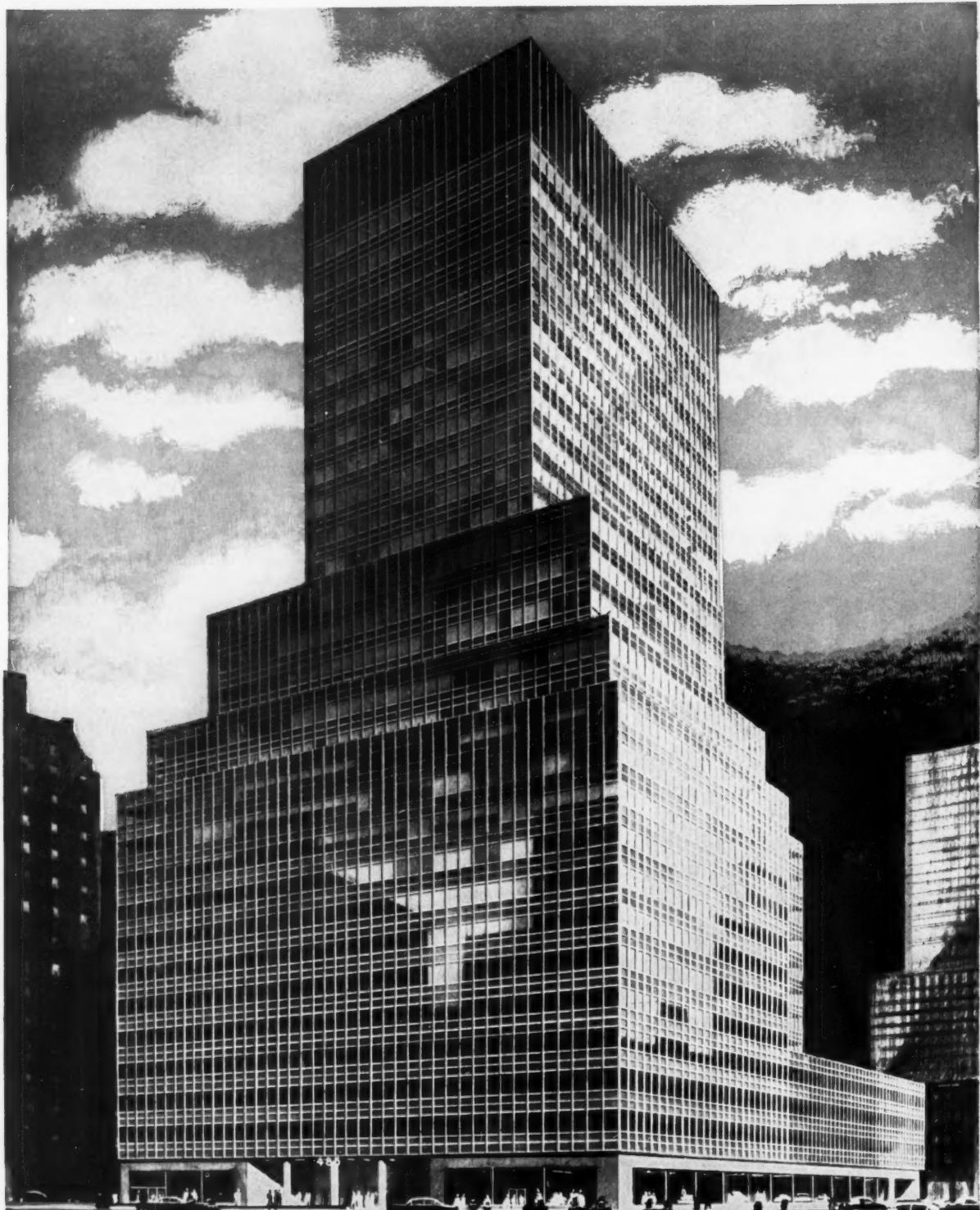
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Estimated available fault current is between 140,000 and 150,000 amperes.

*with fuses—  
safe protection remains safe!*

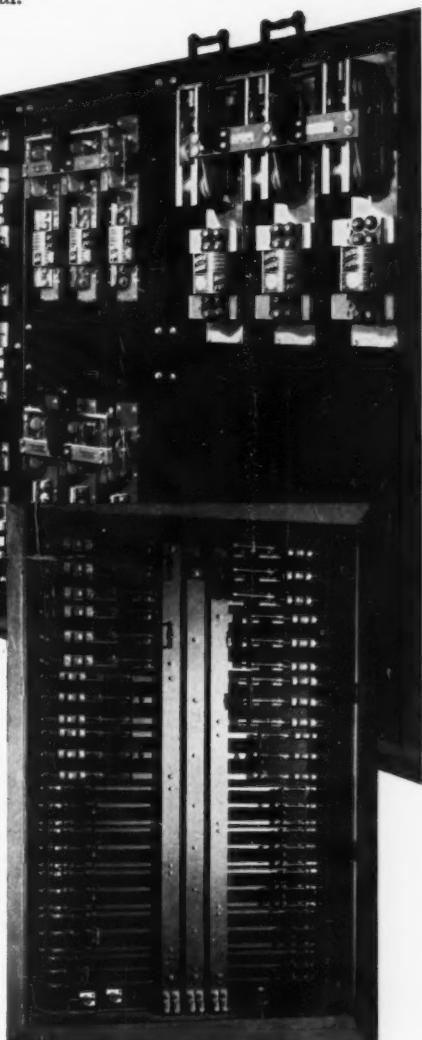
Unlike mechanically operated devices, a fuse has no hinges, pivots or contacts to stick or get out of order. Dust, fumes, corrosion or age cannot increase a fuse's capacity or lengthen its blowing time.

After years of inactivity, a fuse will give the same safe, dependable protection if called upon to open as it would have on the day it was installed.

If a fuse does blow, there is no recalibration needed. As quickly as the fault in the circuit is corrected, you slip in a new fuse, that has been CALIBRATED AT THE FACTORY BY ENGINEERS.

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### Kind Words From Japan

Sir:

The receipt of four copies of CONSULTING ENGINEER and also the directory of advertisers' literature is acknowledged and very much appreciated indeed.

The four consecutive copies of CONSULTING ENGINEER are being avidly read by both our American

and Japanese staff, and both my partner and I find much of valuable assistance in our business, both administratively and technical-wise.

Regarding the directory of advertisers' literature, it appears that we could use to advantage copies of practically the entire list, but are reluctant to appear greedy because of the costs involved. Enclosed is our card denoting the information and literature we believe would be of valuable assistance to us in design and specifications. The receipt of any or all of those numbers circled will really be helpful.

From the interest in the CONSULTING ENGINEER copies read by our Japanese department chiefs, who are registered engineers in Japan, it is evident that they also would like to receive copies. Please advise if they also are eligible to receive CONSULTING ENGINEER.

Arlos R. Sedgley, President  
Sedgley & Associates, Inc.  
Tokyo, Japan

### Pipe Terminology

Sir:

For years I have used the following designations for pipe: pipe for standard pipe; X pipe for extra strong pipe; and XX pipe for double extra strong pipe.

In over 40 years of practice, I never had anyone question the use of these designations. Recently, however, I used these designations on my design drawings for a \$3-million housing project, and the successful vendor said he never saw these designations used and insists that he is entitled to an extra should he be required to furnish other than standard pipe for pipe clearly noted as X pipe.

It was suggested that I should have used the term heavyweight

pipe. The vendor represents a manufacturing company in this territory, and they use the term heavyweight for this pipe.

I would like to hear from other engineers and suppliers regarding the use of these designations. Have they ever seen or used these designations? If you saw these designations on design drawings, what material would you supply?

Henry Hagel  
Consulting Structural Engineer  
Baltimore, Maryland

### Bypass Lighting

Sir:

I have read the excellent article by Ernest Siegel entitled "Bypass Lighting is Different," in the June issue. Such articles are both timely and instructive.

Many persons have commented favorably on the lighting for the project. Having driven most of the major toll road projects in the country, with a highway engineer's eye cocked for observation, I can testify that the Baltimore Harbor Tunnel lighting is superior to any other I have seen. The volume of light on the road where it is needed, lack of glare, and absence of alternate dark and light spots combine to give a most favorable impression.

The report is well written and should be very interesting to the highway engineering profession in general.

Mr. Siegel is to be congratulated for having such a successful project to his credit.

Robert A. Groves, Chief Engineer  
Maddox & Hopkins  
Silver Spring, Maryland

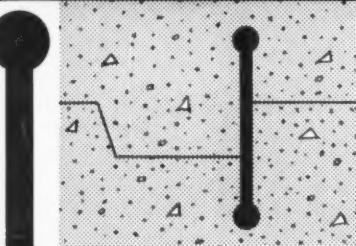
### All Is Vanity

Sir:

In your review of the novel *If It Had Been a Snake* (May 1959),

## WATERSTOPS

FOR MASONRY CONSTRUCTION JOINTS



### RUBBER or VINYL

Williams Efficiency Waterstops are made from Natural Rubber Stock, and designed for maximum effectiveness in any type of cast-in-place construction joint. They will bend around corners—will not crack or tear from shear action. Tensile Test: 3990 lbs.; Elongation Test: 650%. Available in rolls up to 80 feet in length. Field splicing is simple. Williams Waterstops can also be furnished in Vinyl or Neoprene for industrial uses where resistance to oil and other injurious wastes is desirable. These highly effective Waterstops are now in use in hundreds of industrial plants, commercial and public buildings throughout the country.

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**"L&R gate valves pass our 3-point test!"**

Many engineers and waterworks superintendents ask themselves this question before specifying a particular gate valve:

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**WRITE FOR THE L&R GATE VALVE CATALOG**, showing the most complete selection of outstanding design features available today. There are sizes from 2" to 72", plus custom designing for special applications.

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VALVES AND HYDRANTS

THE LUDLOW VALVE MANUFACTURING CO., INC., TROY, N. Y. - SINCE 1861

you state that it is hard to understand how the book could have been published. You also criticize it in other proper ways. As with the authors of *The Ugly American*, who write of engineering without a knowledge of engineering, your reviewer writes of publishing without a knowledge of publishing (or does he know and is not admitting it?). In any case, Vantage Press is what is known as a "vanity publisher," i.e., you pay, we'll publish. They'll publish almost anything—if you'll put the cash down first. If their books (Exposition Press and some others also) seem to have no editing, it is because they have none.

John A. Lynch  
South Bend, Indiana

#### Weatherman Bucks Odds

Sir:  
I enjoyed reading Vogt and Hyman's "How Water Witching Works," in your May 1959 issue.

Speaking of witching, we enjoy poking fun at your "Krick Weather

Outlook." Looking at May, both temperature predictions and precipitation predictions are almost opposite those we recall.

It would be quite interesting to know what the percentage of error is over the entire country.

W. C. Anderson  
Canton, Ohio

#### Burns on the Consultant

Sir:

Congratulations on "What's Wrong With Consulting Engineers," which holds up a mirror to the profession.

It reminds me of Robert Burns' lines "To a Louse"\*

"Oh, wad some power the giftie  
gie us  
To see oursel's as ither see us!  
It wad frae monie a blunder  
free us,  
And foolish notion."

\*Could be that that's the way we  
look to some?

Malcolm Engles Runyon  
Runyon & Carey Associates  
Newark, New Jersey

**have you got the  
facts on money-saving  
preventive  
maintenance with**

## Torit dust collectors?

Clean machines hold close tolerances *better* and *up to 80% longer*. Result: a measurable saving in both the cost and frequency of servicing and maintenance work. You can protect your client's plant and equipment investment, help reduce potential production breakdowns, by specifying TORIT Dust Collectors. In the cabinet type (illustrated by cutaway drawing) filters are rated 99.99% efficient by weight on particles as small as  $\frac{1}{2}$  micron! Compact Torit high efficiency cyclone and cabinet type units are designed to save space, install anywhere. Your Torit representative will gladly give you dust collector specifications, performance charts, dimensional drawings and installation suggestions. Write:

**TORIT MANUFACTURING CO.**  
Walnut & Exchange Streets, St. Paul 2, Minn., Dept. 1617



#### The Salt Lake City Affair

Sir.

This letter is in reference to the article in the May 1959 issue entitled "Field Notes—Trouble at Salt Lake" written by your Eastern Editor, Marjorie Oden. The subject handled in this article is rather delicate in nature, has many ramifications, and should have been written only after careful study. This was evidently not done, because it is full of inaccurate statements.

At the end of the first page you refer to a "consulting engineer from Washington State," and you then outline certain activities of this engineer in connection with a project at Salt Lake City, for which he was the consultant. The implications of this paragraph are not true. The engineer simply required that the specifications as written be adhered to without deviation.

Later on the following page you state "By this time, the Washington consulting engineer was thoroughly disturbed . . ." This again is not true. The engineer paid little attention to the situation, except to make sure that the specifications were adhered to. The Salt Lake area was beyond the normal geographical scope of the engineer's operations, and he was inclined to take a detached viewpoint in the matter.

You later state ". . . so this consulting engineer from Washington . . . got together with the Intermountain Institute of Consulting Engineers and learned that these were not at all unusual practices in Utah." This again is entirely false. The engineer referred to did not approach the Intermountain Institute of Consulting Engineers, or any other member association.

The record will show that the "consulting engineer from Washington" received correspondence from the Intermountain Institute of Consulting Engineers, but not until after letters had been written by engineers practicing in the State of Oregon. In fact, a copy of a letter written by an Oregon engi-

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B-440

neer was sent to the Washington engineer for use as an example.

Referring to the paragraph entitled "Slaughter of the Innocent" and referring to J. Ebbe Jensen of Western Blower Company, Inc., your article states: "He (Jensen) does not have any agent in Salt Lake City." This is not entirely correct, although this manufacturer does not have a written agreement with any agent, we have been told that one such agent does advertise that he represents this manufacturer and purchases from him for resale.

We feel that before she wrote such a critical and long article on such a controversial subject as this, your Eastern Editor should have had the facts at hand.

Under the heading of "Guilt by Association," Miss Oden states "It will be interesting to see whether the Council and its members who wrote so quickly to Mr. Jensen will be as quick to apologize and acknowledge the harm they have

done his company." It will be interesting to us to see whether your Miss Oden will follow her own advice and write a retraction to the many errors, and therefore injustices, created by her article.

Lincoln Bouillon  
Bouillon, Griffith & Christofferson  
Seattle, Washington

#### Gents Room Journalism?

Sir:

Thank you for your very fine example of "Gents Room Journalism" which appeared in your May 1959 issue "Trouble in Salt Lake."

I am sincerely amazed at the character the magazine CONSULTING ENGINEER has now assumed. In this very article you violate the very advice you are tendering, that is "look before you leap."

The statements made by the official of the supposedly condemned manufacturer is false and his "affidavit" is strictly ridiculous. These have only added to the damage that will be heaped upon him and

his company. For your information, I am constantly receiving submittal data on this manufacturer's equipment, along with requests for permission to bid. All of which are coming from his agent designer here in Salt Lake. My files are open to you or anyone else who wishes to verify this statement.

... It will be interesting to see whether your magazine will be as quick to apologize and acknowledge the harm they have done the consulting engineers in Salt Lake City in their ethical campaign.

The very architects listed in your article have used in the past the now independent engineers when these same engineers were associated with agent designers. How come they became so very incompetent and unskilled all of a sudden? It is because these mercenary architects who are yelling the loudest are the ones taking advantage of their client and pocketing unearned change in the form of engineering fees.

It is true, "disagreements can be solved by cooperation rather than accusation" but all attempts for cooperation have been denied us by the other party. We therefore fight the best we know how.

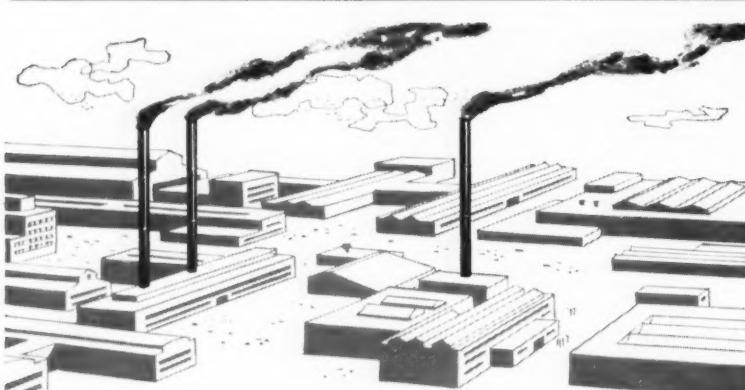
V. Quenton Tregeagle  
Redd & Tregeagle  
Salt Lake City, Utah

#### Conflicting Thoughts

Sir:

The article "Field Notes" in your May issue has left me with a number of conflicting thoughts. Conflicting because of an early background as an agent-engineer, then as an agent, and now as a consulting engineer in private practice.

It is easy for me to conjure up reasons (or excuses) for an agent-engineer in parts of the country where consulting engineers are scarce or nonexistent. There seems little need for such activity in a populated area similar to Salt Lake City. The fact that six architects pooled their efforts to write a statement of their aims and objects is



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- Non-overloading wheel, made of heavy gauge aluminum, is dynamically and statically balanced in the Jenn-Air Sound Laboratory.
- Exclusive guide vane construction improves air moving efficiency while minimizing turbulence and noise.

- Adjustable motor pulley permits speed variation.

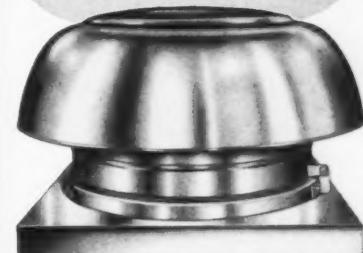
- Totally enclosed motor and tubular drive assembly feature permanently sealed, pre-lubricated ball bearings. Motor is effectively cooled by air stream.

- Bird guard of heavy gauge stainless steel is an integral part of every unit.

- Maintenance-free aluminum housing provides strength without weight.

The HAB Series of "Hi-D" Exhausters (axial blade) gives highest air-per-dollar value in short duct runs where static pressures are negligible. The HCB Series (centrifugal wheel) effectively overcomes static pressures and is usually preferred for long duct runs. Its smaller diameter permits a corresponding reduction in duct size.

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Ask your Jenn-Air representative for performance and dimensional data on the complete line of Jenn-Air Power Exhausters and Relief Vents.

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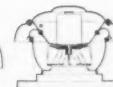
Relief vent



Bell-drive  
centrifugal "Hi-Discharge"



Bell-drive  
centrifugal



Direct-drive  
centrifugal



Direct-drive  
axial



Direct-drive  
centrifugal -  
wall type



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significant. At least the architects are in accord, which lends weight to their position. Too bad the consulting engineers could not combine and unify their thinking and course of action.

The defense of position made by the architects is most peculiar. I wonder if it would please these architects should the various branches of construction industry, such as window manufacturers, roofing applicators, and millwork specialists offer their design facilities directly to the owner.

As stated in the architects' letter, many of these specialty men are indeed working in their own narrow field, and while maybe competent to represent their oldest, best, and eminent principles, they should be good enough to make a good living while doing just that.

It seems to me that each manufacturer, whether included in your list of abstainers or not, would be best served by having his agent devote full time to selling.

One other statement in your article is worthy of comment. I refer to the reply of Mr. Grady of a well known boiler company. Quote, "Our local representatives have many commitments for the balance of 1959." If there have been many commitments, this presupposes that both the engineering and boiler business will be good. Probably enough business to go around, with a little left over for the consultants.

Again to quote Mr. Grady, "We would be very happy to help you" (the consultant). In our section of the country, it is usually considered that engineers and salesmen help each other, but each attending to his own knitting.

Another manufacturer writes that the engineers are "about our best customers," but then attempts to justify agent-engineering by the fact that his representative is a registered engineer and so is within the law. Legally he can do such work, but on failing to land a job of design with a particular archi-

tect, is he in an ethical position in trying to run with both the hare and the hounds?

This same letter hints of a "black list." I must confess that I had no such list, but in the article, the names are sure spelled out. Some of these manufacturers have been at the top of my list of favorites, and to see that they have stooped so low leaves me astonished. Certainly their agents in Ohio have not offered engineering service. In fact, not one of their offices has a drawing board to my knowledge.

I believe that a lot of good will come from your article. Since the writer is listed as Eastern Editor, it would be interesting if she would turn her talents in our direction.

Fred W. Spencer, P.E.

Fred W. Spencer & Associates  
Trotwood, Ohio

#### Rebuttal From IICE

Sir:

A careful study of the "Field Notes" column in the May issue indicates that some of your information was misleading and some was actually in error. In order to set the records straight, the following information is submitted:

¶ You state the need for better investigation and communication if we are to avoid disasters of leaping before looking.

If you had studied each case individually as thoroughly as we had, your article would have been much more understanding.

¶ You state that until a few months ago there had been plenty of talk among consultants but little action.

For a period of at least 10 years attempts have been made on a local level to obtain cooperation among architects, engineers, agent-designers, and sales representatives to clear up this situation. All of these efforts have produced little noticeable results.

¶ You state the architects seem to be satisfied and there had been no complaints from the engineers.

Some architects have been as disturbed about this situation as

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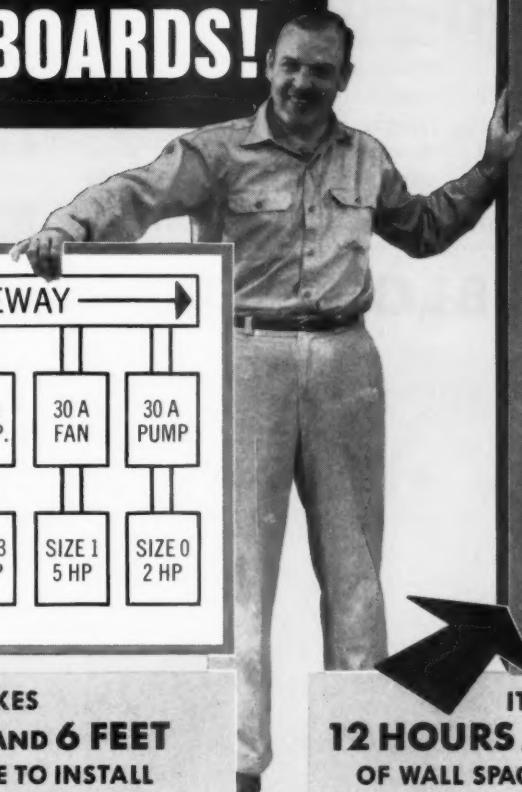
Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps



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IT TAKES  
**41 HOURS AND 6 FEET**  
OF WALL SPACE TO INSTALL  
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AND STARTERS LIKE THIS

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OF WALL SPACE FOR THE  
SAME INSTALLATION WITH A  
QMB STARTER PANELBOARD

Why mount separate starters and disconnect switches? It costs extra money. It wastes space. It takes a lot more time. QMB Starter Panelboards give you a *safer* installation because you can't open a starter when the switch is ON. They give you a much *better looking* job. Since they can even be *flush* mounted, they offer a lot more installation *flexibility*. QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 3. QMB switchboards and unit substations handle sizes 0 through 5. All of them are available, factory-assembled and wired. Or get enclosures, starters and plug-in switch units from your Square D distributor for on-the-job assembly.



Notice how the plug-in switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

It's easy to order these starter and switch units. See Page 57 in your Square D Digest and order from your distributor.



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**SQUARE D COMPANY**

we have. There have been numerous individual complaints by consulting engineers.

¶ You state agent-designers were charging full fees for their engineering services.

We know of no agent-designer in this area who charges what could be considered a full fee.

¶ You refer to one company which was innocently slaughtered because it does not have an agent in Salt Lake City, Utah.

This is by far your most serious error. The "innocent" is not innocent. The company referred to is represented in Salt Lake City by an agent who does designing in competition with the consulting engineers and also receives a commission on all sales in this area. Enclosed you will find a copy of the manufacturer's bulletin listing offices in Salt Lake and the agent-designer's bulletin listing themselves as representatives of the

manufacturer. There is no apology due for our actions in this case.

¶ You state that in some instances companies were contacted which should not have been.

All companies contacted by the IICE were represented in this area by agent-designers.

¶ In the letter signed by six architects, the statement is made that before they "would reject such skilled engineering assistance and counsel as these men (agent-designers) offer, it would have to be demonstrated that by making use of their services we are violating some duty or responsibility which we owe to the clients we serve."

The State Legislature, as a result of experience gained on state jobs, recently passed a law prohibiting the use of any equipment on a state project which had been designed and specified by an agent-designer having any financial connection with the sale of said equipment. This bill was passed independent of any action from the IICE.

¶ You state that it will be many a day before some of the architects in Salt Lake City will feel like working with the consultants.

We have already received favorable comment from some architects in this area for action in this matter. In a Producers' Council Seminar held in Salt Lake May 20, 1959, problems peculiar to the construction industry were discussed. The panel had representation from the professional groups, State Building Board, typical school district, Associated General Contractors, and Producers' Council. The member representing AIA stated that the owner would benefit in the long run by paying fees high enough to allow the architect to pay for the professional services of a consulting engineer.

Intermountain Institute of

Consulting Engineers  
Executive Committee

Arnold W. Coon, President  
William C. Brown, Vice president  
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H. Eugene Nielson, Treasurer



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# Three Important Signal Systems from Honeywell!



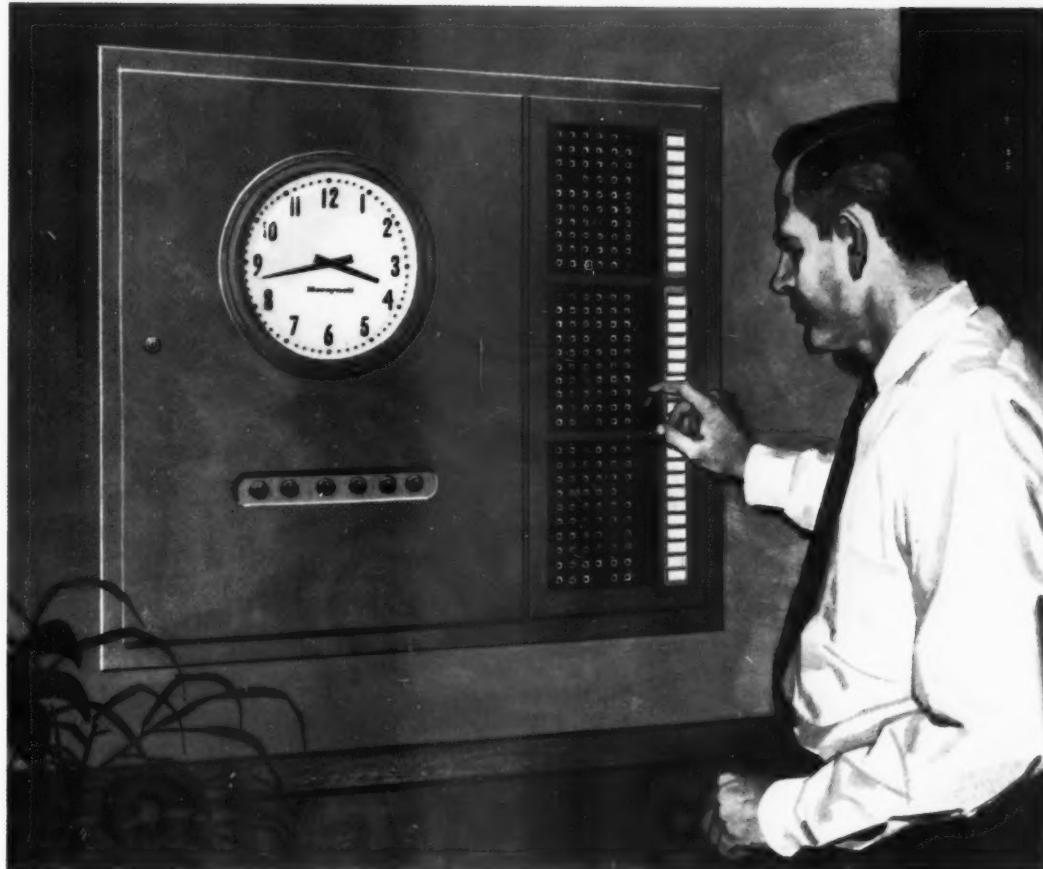
*Clockmaster Time and Programming Systems*



*Fire Detection and Alarm Systems*



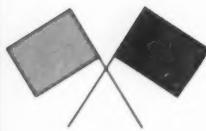
*Surveillance Alarm Systems*



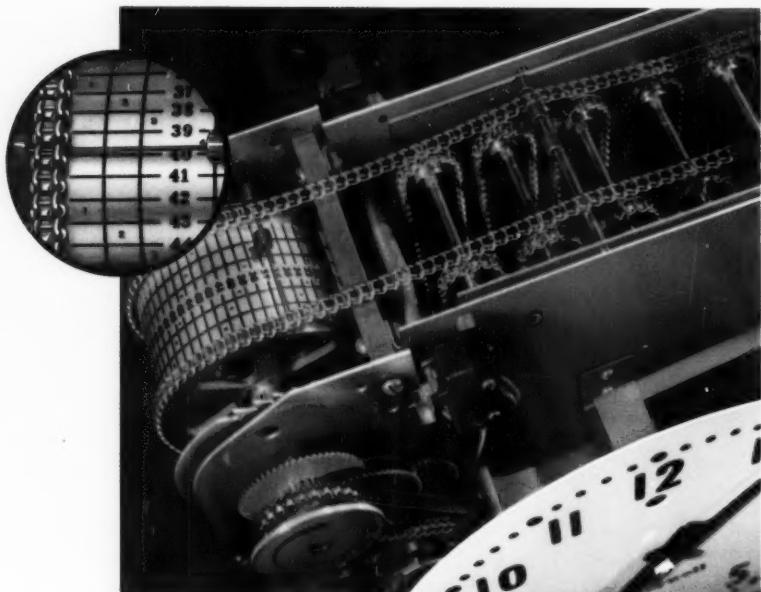
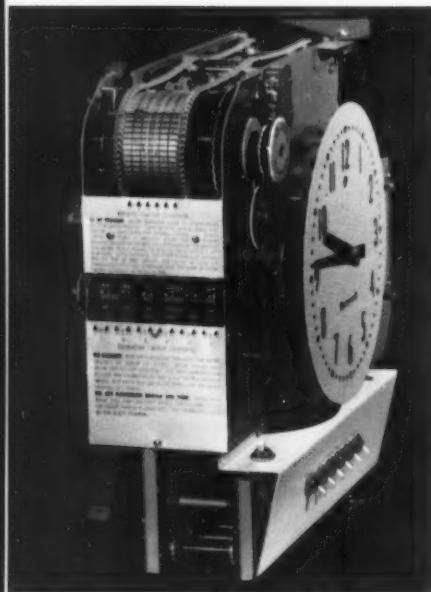
**Honeywell Clockmaster\* Systems** are available in either synchronous wired or minute impulse types. In both systems Honeywell furnishes flush or surface mounted clocks in 9", 12", 15" or 18" dials. Both systems are self-correcting every hour with independent correction for each clock in the system.

A switch on the master clock permits substituting

manual switching or silence instead of automatic programming. Quick-change calendar device permits silencing any circuit during any 12 hour period of the week. A spring power unit is available for emergency use during power failure. Honeywell's system is especially wanted in schools because it offers the easiest-to-set programming on the market. • • • •

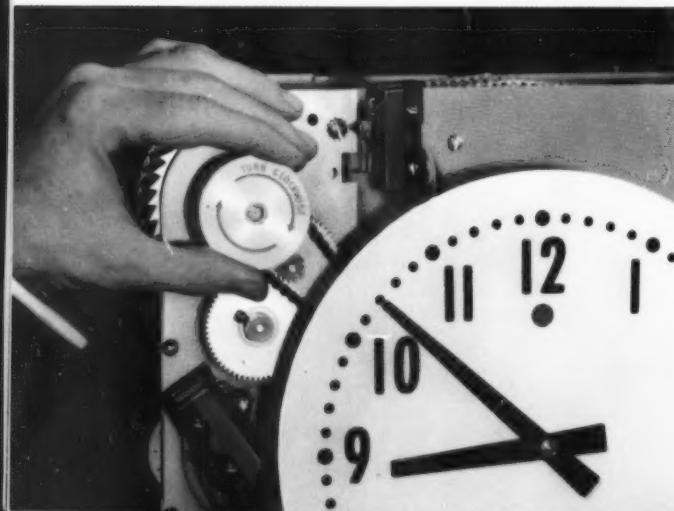


## Here's why Honeywell Clockmaster Programming is the easiest to set!

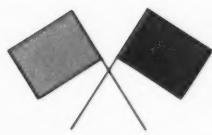


**Easy-to-set signal drum.** Honeywell's Clockmaster eliminates fuss and bother from program setting. Just turn signal drum to time, slip steel pin through chain links and slide on one of the reusable plastic rollers. To change signal, roller can be shifted without affecting any other part of the program. Special round pin-in-square-hole construction holds each signal roller firmly in place.

**Easy-to-read numbers: Link chain ruggedness.** Numbers on the signal drum are large, easy to read, and never confuse the program setter. Two precision link chains, color-coded for day-night identification, guide the entire program whether it includes three circuits or six. Chains are rated at twenty times load for insurance against breakage. Chains run continuously over idler gears. No piling at bottom of cabinet.



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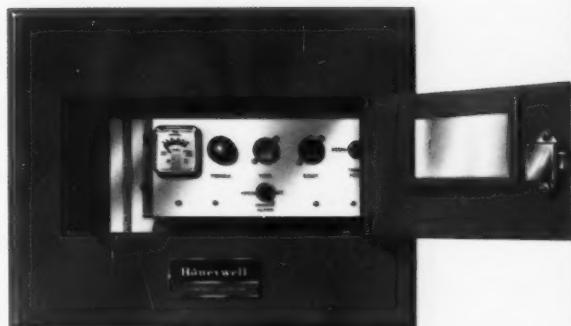
## Honeywell's complete fire detection and alarm equipment offers greater flexibility... one reliable source!



Detector



Manual Station



W247 Panel

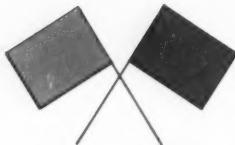
Now depend on one reliable source, Honeywell, for a fire detection and alarm system to meet the requirements of any building. Honeywell furnishes manual, automatic and sprinkler-water-flow systems, singly or in combination,

furnishes all components, too—panels, detectors, manual stations, switches, bells, horns and buzzers. They're all built to rigid quality standards—all backed by Honeywell and famous Honeywell service.



Numbered lights identify a fire's location with Honeywell's W237 panel. This enables a supervisor to direct immediate fire fighting measures. Other features of this system include electrical supervision of the detecting circuit. Trouble signal and light indicate any wiring break. Signal may be silenced until repairs are made but trouble light stays on. Alarm will sound even if there is a break in the detecting circuit. And entire system may be tied in to local fire and police headquarters.

Honeywell's W247 panel uses a 2-wire circuit designed so that both detector and alarm circuits are electrically supervised. Any wiring break is immediately indicated by a trouble signal. If system is connected to a municipal alarm, a switch disconnects it during fire drills. Features large bell capacity—up to 5 bell circuits operating a total of up to 50 bells.



## Honeywell Surveillance Alarm Systems

help prevent breakdowns of critical equipment  
with economical one-man supervision

Wherever important operating equipment is scattered throughout a building or group of buildings it requires frequent checking. However, it needs actual maintenance attention only if there is trouble. Honeywell Surveillance alarm system replaces intermittent personal checking with continuous automatic supervision of boilers, compressors, tank levels, fans, motors and other critical equipment.

Red lights identify and locate trouble. Panel supervisor at central location can communicate with maintenance men who will correct trouble before it becomes extensive enough to cause a breakdown.

Unique circuitry permits a single pair of wires to carry warning signals from several pieces of equipment in the same area and to provide emergency communications with the area.

All connecting wires are electrically supervised so that any wiring break sounds a trouble signal. Thus the system supervises itself as well as the equipment it guards.



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**LATEST IN COOLING** Gas operated York machines feature the use of tap water as refrigerant and lithium bromide as absorbent, one of the most efficient, practical refrigeration cycles developed so far. Machines start and stop automatically.



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*all summer"*

"With our boilers sized for a winter load, we were naturally oversized for the summer months. But York's gas-operated Lithium Bromide absorption water chillers permit us to make efficient use of part of this steam capacity to cool," says Mr. M. J. Mather, President of the Allen Manufacturing Company, makers of hex-socket screws.

The York Lithium Bromide system eliminates the need for huge compressors found in other types of cooling equipment . . . which brings down the original cost considerably. And with gas as the boiler fuel, you make year-round use of an otherwise wasted source of power *at rock bottom costs*. In addition, York machines are noiseless, lightweight, compact — easy to install and readily adaptable to almost any plant layout.

Find out how your present heating system can pay off for you all year 'round with gas-operated York automatic water chilling units. Call your local gas company or write to the York Corporation, Subsidiary of Borg-Warner Corporation, York, Pennsylvania. *American Gas Association.*



**Neglected  
Auxiliaries**  
(page 94)

# The Readers' Guide

Few power plant auxiliaries have been the subject of more intensive technical investigation than the condenser. It would be hard to recall an ASME annual meeting at which condensers did not get a good going over in a number of worthy papers. Yet, with all the attention focused on these important pieces of power plant equipment, there seems to have been an almost conscious desire to ignore all of the other components that make up a station's circulating water system — the screens, racks, pumps, and conduits, for example — that make the functioning of the condenser possible. R. T. Richards, an Ebasco engineer, has turned against the stream and concentrated his studies on what he calls "Some Neglected Design Problems of Circulating Water Systems." His findings will be of interest to any engineer who deals with large fluid flow systems.

From time to time we have published descriptions of new offices and office buildings designed and built specifically for firms of consulting engineers. Some of these have been large, some small, but regardless of size, each included special features that improve efficiency, cut operating cost, or in some way assisted the firm in better serving its clients. In this issue we have another description of an excellent new engineering building. This one is in Kansas City, and it houses the rapidly expanding firm of Burns and McDonnell. Just one example of modern design is the 120-footcandle lighting level in the drafting room. To an old "50 footcandles should be plenty" man, this sounds like more than enough, but times have changed, and already Burns and McDonnell are installing new tubes that will raise the level to 170.

**More Hope  
For Fewer Fires**  
(page 102)

Last month Robin Beach, one of the country's acknowledged experts on electrically caused fires, wrote for us the intriguing article, "Arsonist on the Premises," in which he pictured with startling clarity the dangers of improperly installed, poorly maintained, or overloaded flexible armored cable of the old Type AC. He follows up this month with another good story that offers a bit brighter future for fire fighters. While Beach reports that when improperly installed or maintained the new type ATC cable with bonding strip offers only a slight safety advantage over the old, his tests also show that it is nearly impossible to actually start a fire by overheating either rigid metal conduit or thin wall tubing. But that is only part of the story. You will want to read it carefully so that you and other "Consultants Can Specify Fewer Fires."

It will make most of us feel better to know that Chester W. Lyon, personnel manager of Howard, Needles, Tammen & Bergendoff, does not think that top grades in school necessarily mean top achievement in engineering work. Lyon is not against the young graduate who leads his class scholastically, but he does feel that something more is needed for success in a consulting engineer firm. To find out what the extra factor is, see "Get the Graduate That Fits the Firm."

**Infancy of  
Iron Bridges**  
(page 114)

**B & McD Gets  
New Building**  
(page 106)

**Hiring Young  
Graduates**  
(page 136)

Richard Sanders Allen is no engineer, and he does not claim to be a bridge designer, but he does know more about old bridges than anyone else in the country. For many years he has collected photographs and drawings of old American bridges, spending all his spare time traveling about the country looking for unusual specimens or forgotten sites. He has written a book *Covered Bridges of the Northeast* and several well received articles for CONSULTING ENGINEER. In this issue he adds another, which he calls "America's First Iron Bridges." It may surprise many readers to learn that the first iron bridge designer in this country was Tom Paine, the Revolutionary patriot.

Premier performance of the west's first BEATTY-PECCO CONSTRUCTION CRANE

# 15 WORK DAYS and the steel is UP



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Progressive contractors, architects, and engineers have been waiting for this bold new approach to materials handling . . . and now it's here in the West. Not just a crane — but a construction *method* to help increase time-economy by more than 40%.

Jobs like the one here move *faster* with Beatty-Pecco. If you have a project where time can make the difference, you'll want to investigate the Beatty-Pecco Construction Crane.

For complete details: **WRITE, WIRE or PHONE:**

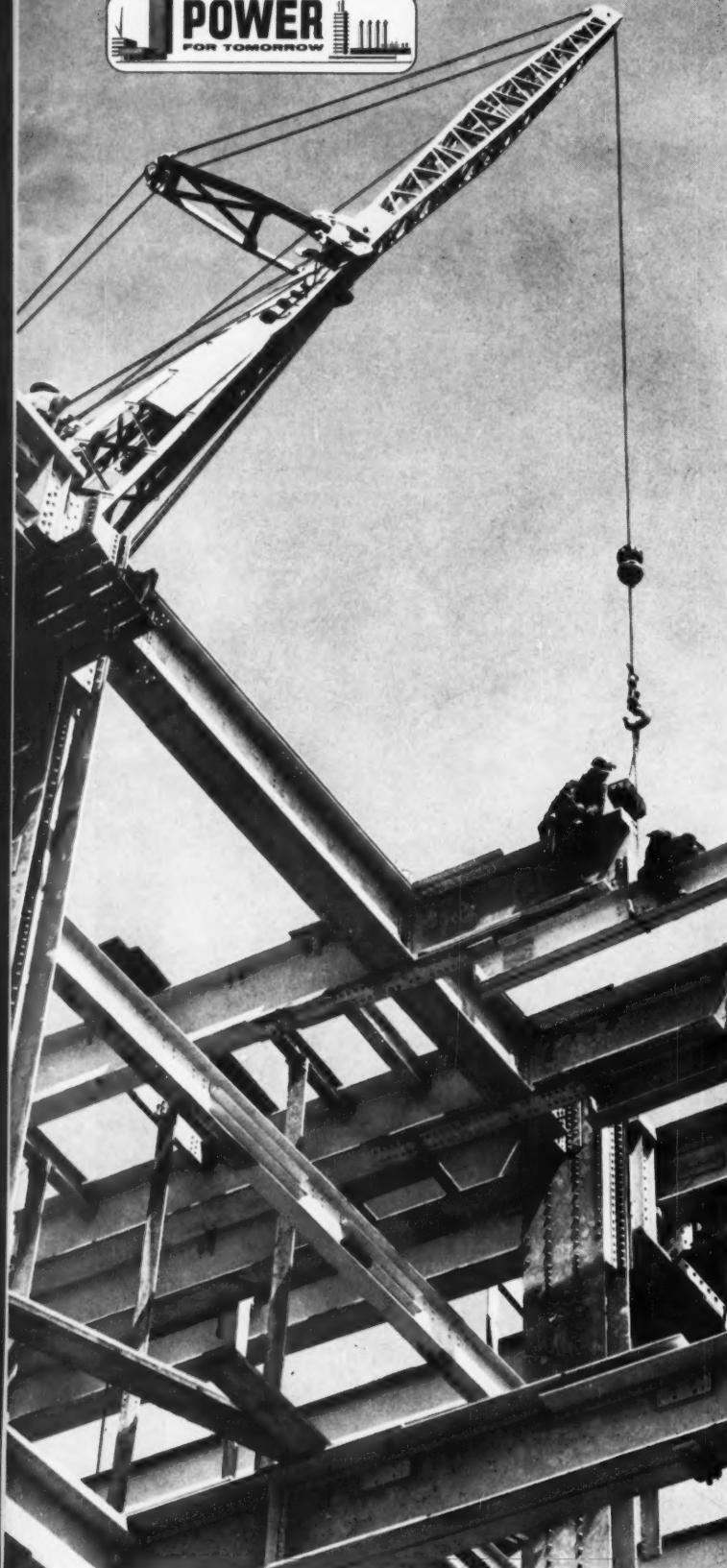
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**BUILDING SIZE** affects savings possible with General Electric 480Y/277-volt equipment. Where feeders exceed 200 feet, G-E 480-volt system serves load with 50% less copper than 208-volt installation.

## Building or Modernizing?

**Be sure your plans include power distribution equipment engineered to handle tomorrow's heavier electrical loads**

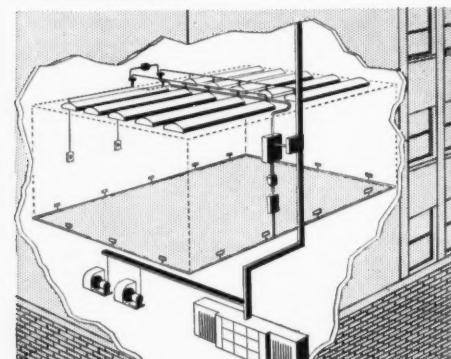
With the increased use of air conditioning, business machines, electronic equipment and higher-level area illumination, building services (and tenants) may suffer unless your power distribution system can satisfy growing load demands with stable power. Building or modernizing, you can solve this problem by specifying General Electric 480Y/277-volt\* power distribution equipment. Here are two good reasons why—

**SAVINGS TO \$30/KVA** are possible with a G-E 480-volt system because it requires less copper and fewer components than conventional 208-volt installations. General Electric substations, for example, use standardized, packaged components . . . preassembled to save space and reduce installation time and costs.

**COMPLETE G-E ENGINEERING SERVICES**, available right from early planning stages, can help you and your consultants work out the 480Y/277-volt system arrangement best suited to your present and anticipated power needs. Result: sizable first-cost dollar savings and expandable, efficient system performance.

**FOR MORE INFORMATION** on General Electric 480Y/277-volt power distribution equipment, contact your nearest G-E Apparatus Sales Office or write for Bulletin GEA-6851. General Electric Co., Section 680-16, Schenectady 5, N. Y.

\* Identical to 265/460Y.



**CUTAWAY** shows basic loads—lighting, motors, general service—supplied by G-E 480Y/277-volt equipment with fewer feeders, components than 208-volt system. Result: savings in space, equipment costs.

*Progress Is Our Most Important Product*

**GENERAL**  **ELECTRIC**

**POWER**  
**SPEED**  
**COMPACTNESS**

Fisher-Continental Type 480 will  
 give you all 3 on your next

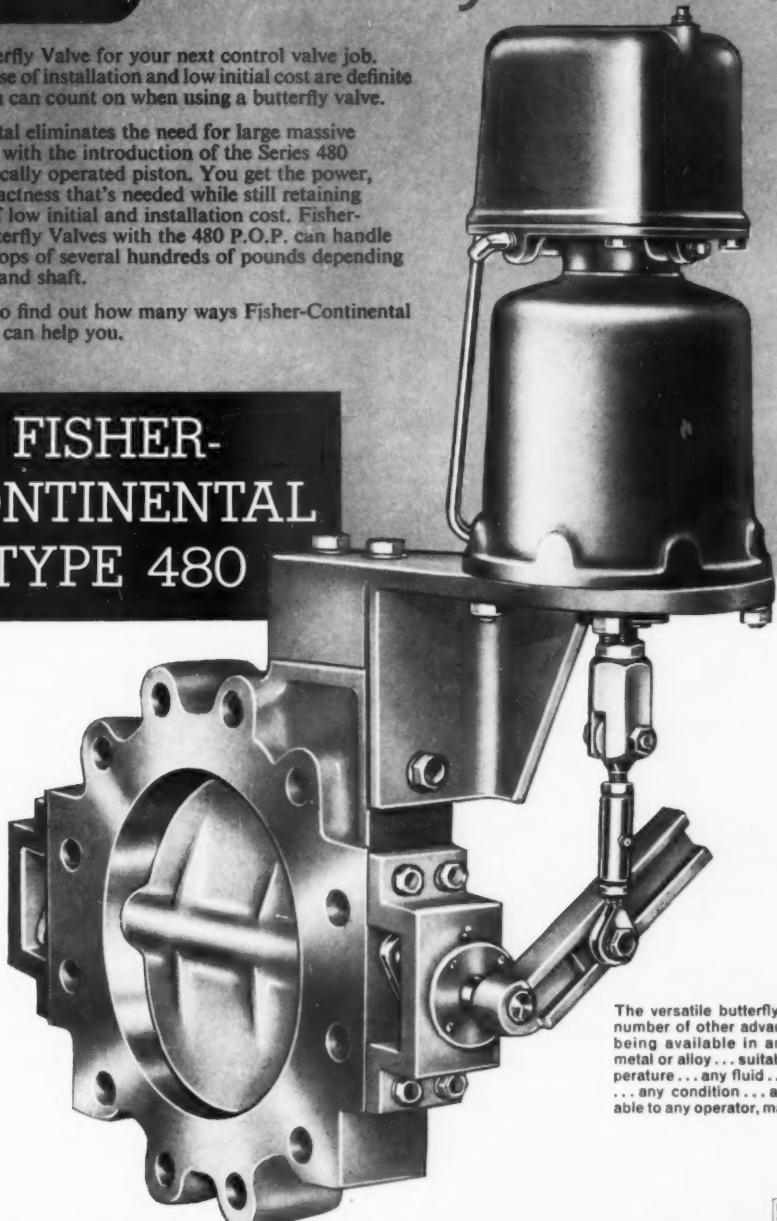
## Butterfly Valve Job

Consider a Butterfly Valve for your next control valve job. Compactness, ease of installation and low initial cost are definite plus features you can count on when using a butterfly valve.

Fisher-Continental eliminates the need for large massive power actuators with the introduction of the Series 480 P.O.P. pneumatically operated piston. You get the power, speed and compactness that's needed while still retaining the advantage of low initial and installation cost. Fisher-Continental Butterfly Valves with the 480 P.O.P. can handle high pressure drops of several hundreds of pounds depending on size of body and shaft.

It will pay you to find out how many ways Fisher-Continental Butterfly Valves can help you.

**FISHER-  
 CONTINENTAL  
 TYPE 480**



The versatile butterfly valve offers a number of other advantages such as being available in any size... any metal or alloy... suitable for any temperature... any fluid... any pressure... any condition... and it is adaptable to any operator, manual or power.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

**FISHER GOVERNOR COMPANY**

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BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PENNSYLVANIA



SINCE 1860



IN HIS REPORT to the General Assembly of the International Federation of Consulting Engineers, held this year in The Hague, President Julian Tritton said, "The most important item in this year's Annual Report is the expansion of FIDIC by the addition of four new member associations, those of Australia, Canada, South Africa, and the United States of America."

No one would argue with Mr. Tritton about this, despite the fact that none of the delegates from the new member associations contributed much to the one day business meeting. Neither they nor the old delegates really had an opportunity, for FIDIC's General Assembly is not conducted as a field day for delegate participation. Instead, it has been, for years, the kind of show in which the executive committee performed from center stage while the delegates watched from the pit.

The 19-item agenda of the meeting was made up either of routine items ("Apologies for absence," "Approval of minutes of the last meeting," "Treasurer's report," etc.) or reports from the president or the executive committee dealing with the committee's accomplishments or its plans.

Item 17 on the agenda was "Election of officers and members of the executive committee," who, according to the constitution, are elected for four year terms. This important item was handled quickly and quietly. The current officers and members of the executive committee simply offered themselves for reelection, and the delegates raised their hands to indicate unanimous approval. Just before the election it was suggested that the two members of the executive committee who were not officers (the committee is made up of the president, vice president, secretary, treasurer, and two others) offer themselves for reelection for only one year instead of four. Dr. P. Walter, of Germany, and Mr. Hylland, of Norway, the two affected by this shortened term of office, happily agreed, and all the delegates again raised their hands. The constitution

## From the Editor's Tranquil Tower

was casually pushed offstage right, and the meeting proceeded to the next item of the agenda.

The delegates from the new member associations were a bit shaken by a meeting conducted *le roi le veut* by the officers and rubber stamped by the General Assembly, but an observer with some background in FIDIC affairs could see that this method of operation is not without its good aspects. It is based not only on convenience but to some extent on necessity.

Language, for example, is a barrier to general participation by the delegates. The assemblies are in English (or a reasonable facsimile thereof) and at this meeting all the delegates and most of the observers understood and spoke English, but it is unreasonable to expect delegates in a group having eight different native tongues, plus several variants, to jump quickly to the floor to express themselves in the English language on every matter on the agenda. This communications problem, alone, has made it necessary for the executive committee to take much more authority and responsibility than would be expected of a committee heading a unilingual group.

It must be understood also that FIDIC is not an association; it is a loose federation of national associations of consulting engineers. The several national associations, in the past, did not expect FIDIC to do much more than provide the prestige associated with international affiliation. The delegates not only were willing but anxious for the executive committee to take full charge of and responsibility for what little there was to do.

Now, with the addition of the four new national associations, all non-European, there are going to be some changes. President Tritton thinks that this recent meeting in The Hague marks a major turning point for FIDIC. During the coming year he and his fellow officers are going to work out ways to expand representation on the executive committee, enlarge the activities of the Federation, and put more work and responsibility in the hands of delegate committees.

At the next general assembly, to be held in Stockholm next spring, the executive committee will present a new plan of organization and operation. It will be interesting to see what effect this reorganization will have on FIDIC, potentially the most important of all consulting engineer organizations. **▲**



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# NEWS FROM YARWAY



**SEALING VALVE**  
The famous tight-sealing Yarway Seatless Valve

**BLOWING VALVE**  
The new wear-resistant Yarway (Stellite seat and disc) Valve

**BODY**  
A rugged, forged steel block

**NOW!** A NEW YARWAY UNIT TANDEM BLOW-OFF VALVE FOR MEDIUM PRESSURE BOILERS

There's a new star in the Yarway Blow-Off Valve line.

For years rugged Yarway Unit Tandem Blow-Off Valves have been standard equipment on most high pressure boilers. In fact, more than 80% of high pressure plants use Yarways.

Now a *new design* Unit Tandem is offered for *medium pressure boilers to 665 WSP*. Streamlined, lighter in weight, easy to operate, tight sealing and long wearing—this valve brings premium quality Yarway Unit Tandem dependability to the medium pressure field—*at a competitive price!*

Important features, like the nitr alloy plunger in the sealing valve and integral stellite seat and disc in the blowing valve, make this your best buy for blow-off service.

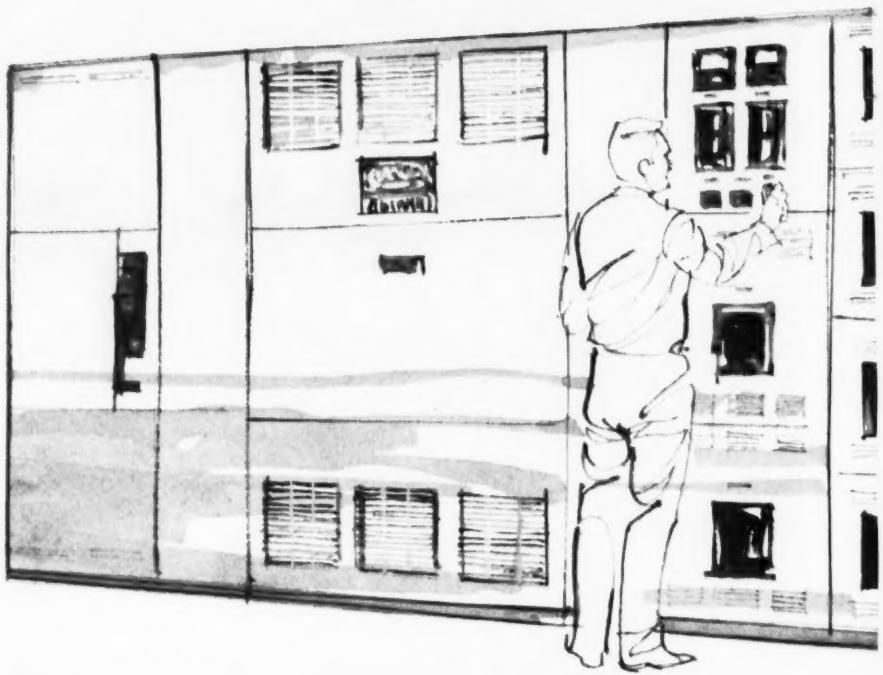
Order Yarway Unit Tandems for your present boilers—or specify them on new boilers.

For full details write for Yarway Bulletin B-435, Supplement A.

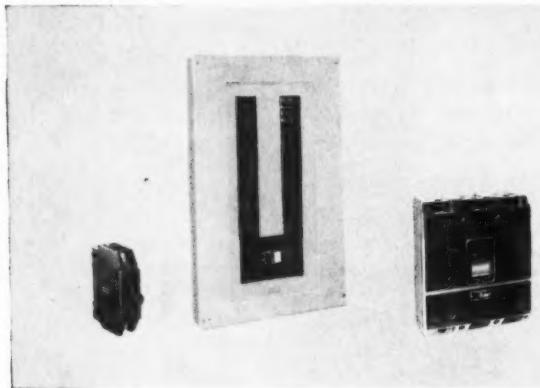
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# YARWAY

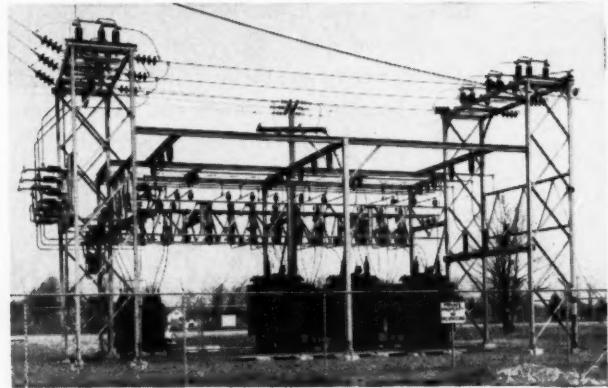




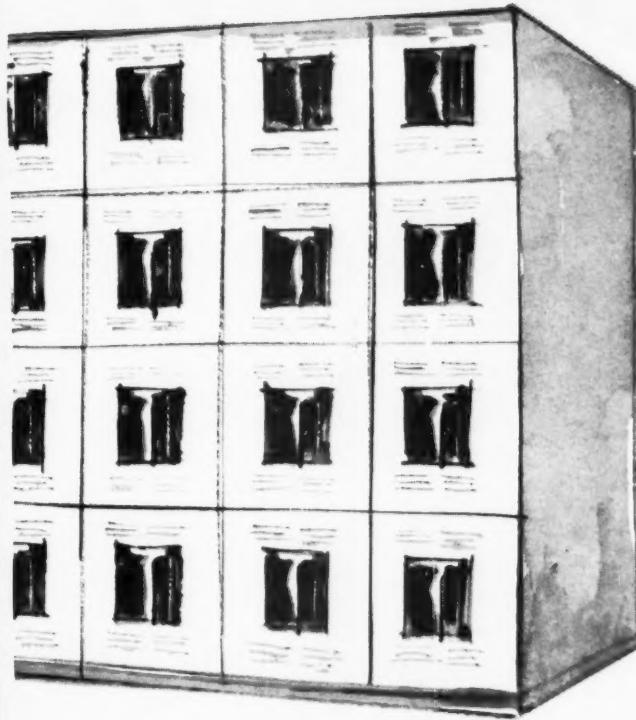
# PRECAUTIONS



**Keeping the bugs out of panelboards.** The better construction of I-T-E molded case circuit breakers means more dependable performance. Broadest range of sizes and types in ratings of 15 to 800 amp continuous. Wide pole spacing eases installation and increases safety. Panelboard models have enclosed front-connected pressure terminals that accept conductor sizes commensurate with breaker ampere ratings. In larger sizes, convenient externally adjustable instantaneous trip permits easy, fast setting to load requirements.



**Outdoor structures . . . controlled every step.** I-T-E not only handles all the designing and fabrication of complete outdoor structures, but does it all in the same plant—under one responsibility. Once the single-line diagram has been prepared, engineering and manufacturing personnel closely coordinate every step of structure production. Customers benefit from a more efficient use of materials, easier and faster erection at the site, and virtual elimination of rework. Structures are available in steel or aluminum for any application requirements.



In specifying an I-T-E secondary unit substation, you take no chances on whether it will install and work properly. Because I-T-E has already taken elaborate precautions to insure that it will.

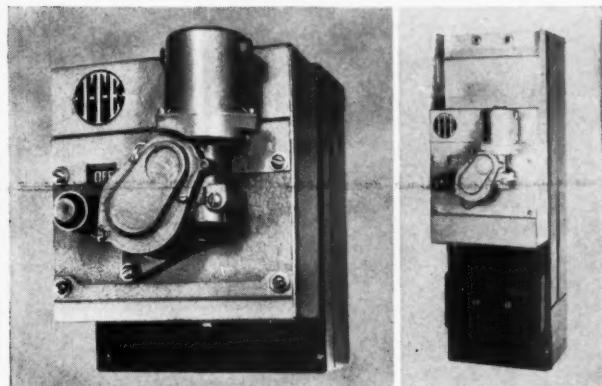
First, only I-T-E builds complete unit substations in one plant . . . where transformer engineers and switchgear engineers work within walking and talking distance of each other. This insures better coordination of design for superior performance.

Second, your substation is completely assembled at I-T-E and tested before shipment. This insures that all parts fit

together and holes match up, and that it will meet its electrical specifications.

Third, every I-T-E substation is shipped complete at one time . . . to arrive on schedule and for immediate installation. This insures against costly installation delays and having substation parts standing around in the weather waiting for other parts to arrive.

You will be taking a wise precaution to specify I-T-E whenever you choose electrical equipment. Because throughout the line, I-T-E has taken precautions to give you better equipment at no greater cost.



**Molded case economy . . . remote control luxury.** Now I-T-E molded case circuit breakers are available with new TELEMAND® motor-operators for remote opening, closing or resetting. Pushbutton control from a distance at far greater economy than alternative devices. Permits automatic operation. Also operable direct.

\*T.M. I-T-E Circuit Breaker Co.

P-3

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<input type="checkbox"/> Molded case circuit breakers	<input type="checkbox"/> Metal-clad switchgear (4.16 and 13.8 kv)
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<input type="checkbox"/> TELEMAND motor-operated molded case circuit breakers	<input type="checkbox"/> Primary unit substations

Other .....

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Company .....

Street .....

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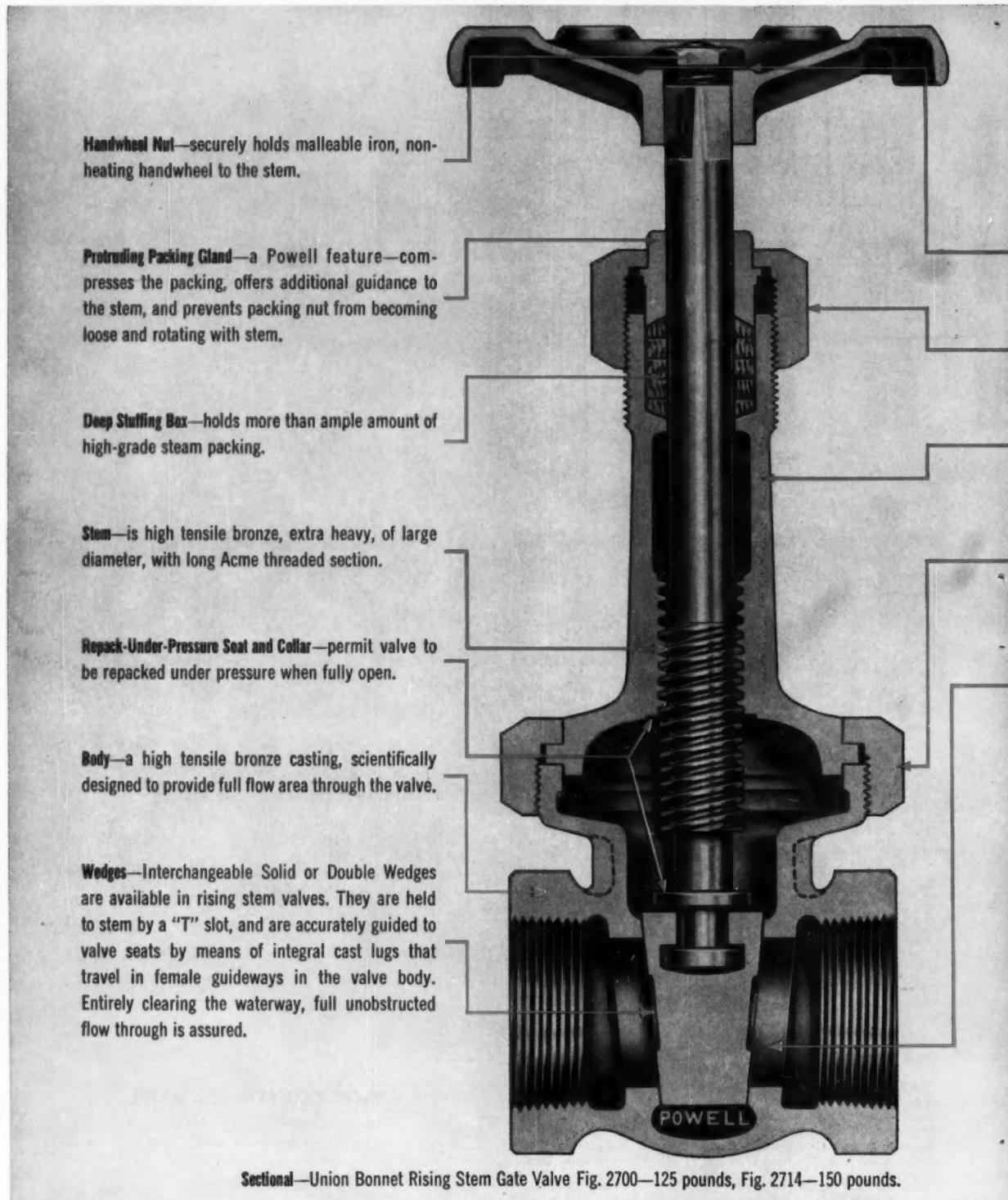
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**I-T-E CIRCUIT BREAKER COMPANY**

# ANNOUNCING NEW **POWELL**



Sectional—Union Bonnet Rising Stem Gate Valve Fig. 2700—125 pounds, Fig. 2714—150 pounds.

**POWELL**... world's largest family of valves

# BRONZE UNION BONNET GATE VALVES

## for 125 and 150 pounds WSP

These new BRONZE Union Bonnet Gate Valves have many superior features—some of which are outlined here. For complete details, write for new illustrated circular. Or check with your nearest Powell Valve distributor.

**Identification Plate**—gives Figure Number and kind of valve.

**Heavy Hexagonal Packing Nut**—for holding gland and adjusting packing.

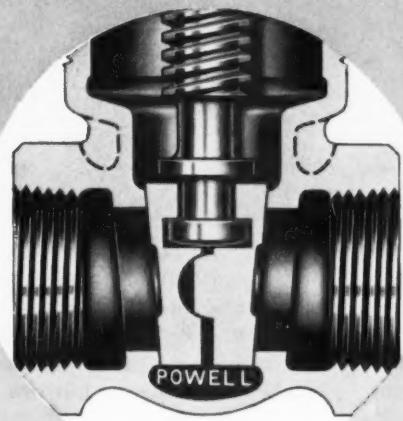
**Long Bonnet**—cast of high tensile bronze for long service.

**Octagonal Ring Nut**—is deep threaded and tightly holds body-bonnet connection. Affords additional wrenching positions.

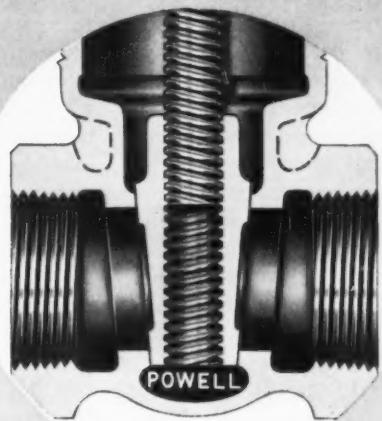
**Ample Space**—between seats and end of pipe thread prevents injury to seats when screwing pipe into the body.



Fig. 2707—125-pound Union Bonnet Non-Rising Stem Gate Valve. Also available for 150 pounds—Fig. 2712.



Detail of Sectional View Inside Screw Rising Stem Gate Valve showing Double Wedge Disc and Integral Seats.



Detail of Sectional View Non-Rising Stem Gate Valve showing Solid Wedge Disc that rises on stem. Integral Seats.

**THE WM. POWELL COMPANY • Dependable Valves Since 1846 • CINCINNATI 22, OHIO**



## Report from the West Coast

RALPH S. TORGERSON

West Coast Editorial Representative

**KEEPING COSTS DOWN** to permit profitable operation is one of the biggest problems faced by consulting engineers. One helpful approach is the use of a progressive accounting system that permits checking of direct costs against the project budget on a current basis. Frequently, excessive costs can be detected and corrective action taken, and the record remains as a permanent guide for future projects of a similar nature.

Overhead is a particularly difficult area for cost control. Because these items include practices that are considered routine and do not change, excessive overhead costs often escape detection. A case in point is the cost of printing reports, studies, brochures, and standard forms. Many firms depend on outside printing service or invest in expensive equipment, purely on the basis of tradition. A careful analysis of the printing load often may reveal important savings through a change in existing practice.

### Monthly Cost Studies

James C. Howland, of Cornell, Howland, Hayes and Merryfield, Corvallis, Oregon, reported that since the firm was organized in 1946, the accounting system has provided a procedure for distributing all direct costs on each project. It is done on a monthly basis.

"Over the last several years," said Howland, "it has been the duty of our assistant manager to make a monthly comparison of the costs on each job, including the general overhead costs. This analysis is distributed to each partner and each project engineer. We have found it rather difficult to correct excessive costs on a particular job once it really gets under way, but the cost checks are helpful to us in estimating future work. Also, knowing that the jobs are to be checked continuously, we feel the project engineers operate with more concern for keeping costs more closely in line with income.

"Recently we began processing our payroll through the IBM Service Bureau Center, in Portland. We transmit to the Service Bureau our monthly time and expense sheets on which employee time is charged to the various project and overhead accounts. In addition, we send our other invoices for expenses. The Service then processes the payroll, writes the checks, and gives us the project cost distribution, all in a matter of 24 hours. We previously had three girls in our bookkeeping department for our 90-man organization. By use of the IBM procedure, we have eliminated one girl and the monthly cost of the service is less than the monthly cost of the girl. In ad-

dition, the cost analysis information is available at the same time as the payroll rather than some two or three weeks later.

"We have gone to Multilith equipment for reproduction of reports, specifications, drawings, and photographs. We use a model which has special attachments for reproducing 11-in. x 17-in. sheets with a maximum impression area of 10½-in. x 16½-in. We reduce all our drawings to 11-in. x 17-in. to go with the contract documents for bidding purposes. These are run on the Multilith, as are multicolor figures and photographs for reports. When we purchased the Multilith equipment in March 1957, we estimated that the savings would pay off the equipment in three or four years. It is our conclusion now that we have not reduced our reproduction costs, but we have greatly improved the quality of our work. The cost now is comparable to our previous costs using mimeographing and single-color blueline prints. We have speeded up the reproduction of those drawings that do not have to be reduced in size, by the use of ink drawings on Mylar. From these positives we make the Multilith plates directly, without making a negative.

"Other items which we have found improve our work or reduce costs are central dictation machines

The Esso Research Center's 3-story, 600-ft.-long office building includes conference rooms, technical library, correlations and computer center, medical department, cafeteria and landscaped court for its 800 employees. The project was designed and engineered by Voorhees Walker Smith Smith and Haines of New York City. Frank Briscoe, Inc., Newark N. J., is general contractor. August Arace & Son, Inc., Elizabeth, N. J., is mechanical contractor for heating and air conditioning. Alward Construction Co., Bernardsville, N. J., is doing the insulation work.



# Esso Research Center uses GILSULATE® for insulating mile of underground steam pipes



GILSULATE goes in fast. In the foreground the field inspector checks depth of pour. Directly in back of him, two workmen are shovelpointing and tamping. Other workers are sliding GILSULATE bags into pipe trench while men at rear are placing plywood forms near manhole.

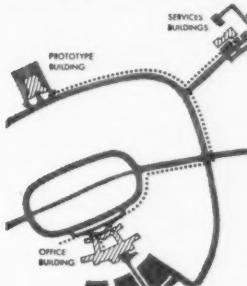
## FACTS ABOUT GILSULATE

1. **EASY TO USE**—just pour, shovelpoint and tamp... pipe heat does the rest.
2. **FORMS 3 ZONES** of protection against heat loss and all hazards commonly encountered by buried hot pipes.
3. **NEEDS NO HOUSING OR MECHANICAL SHEATHS**: no mixing, special handling or equipment.
4. **ONLY NEEDS NORMAL PIPE SPACING**: for multiple pipe or cramped conditions.
5. **THREE TYPES AVAILABLE**:  
Type A for 220-300° F. temp. range  
Type B for 300-385° F. temp. range  
Type C for 385-520° F. temp. range

Esso Research and Engineering Company, the scientific and engineering affiliate of Standard Oil Company of New Jersey, is now constructing a modern research center in Florham Park, N. J. To preserve the natural beauty of the 675-acre site, all heating, air conditioning, power and communications lines are run underground.

Steam, at a pressure of 250 lbs. (406° F.), will flow through a 600-ft.-long, 12" welded steel pipe from the boiler room to a manhole where a 1400-ft. string of 10", 8" and 6" pipe will carry heat to the prototype building. Similar piping leaves the other side of the first manhole and runs 2500 feet to the main office building. Trenches also carry 3" to 6" condensate return lines. The system has 24 expansion loops and seven manholes, and includes capped lines for use when facilities are expanded.

Over 500 tons of GILSULATE will be used for insulating and protecting the underground steam pipes. In addition to its low thermal conductivity, GILSULATE resists attack by acids, alkalies and electrical conductivity and provides excellent protection against corrosion. For full information on this low-cost, poured-in-place insulation, see your local GILSULATE distributor, or write our Salt Lake City office.



THE TRIPLE-ZONE INSULATION FOR LIFETIME PROTECTION OF UNDERGROUND HOT PIPES



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**to know  
WHO'S  
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large hospitals  
with many doctors  
and many entrances  
need**

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SINCE 1892  
**"Dial-In"**

**Doctors'  
IN-OUT Systems**

Small Dial-Registers make every entrance a convenient check-in point. Eliminates all space problems, minimizes installation expense, simplifies expansion. Ideal for new or existing hospitals.



**DOCTOR ARRIVES OR LEAVES**  
Using any convenient entrance, he dials his code number and presses IN or OUT button on small Dial-Register. That's all!



**IS DOCTOR IN?**  
To find out, operator dials his number on small IN-FORMER. Light signal tells her instantly if doctor is in or out.

**Auth**  
SINCE 1892  
ELECTRIC CO., Inc.  
Mail Coupon For Complete Details

**AUTH ELECTRIC CO. Inc. Dept. CE-7  
Long Island City 1, N. Y.**

- Please send complete details on the AUTH "Dial-In" System.
- Put my name on your mailing list.

Name..... Title.....

Address.....

City..... Zone..... State.....

and leasing of pool cars. We have installed Dictaphone Telecord stations so that a dictating phone is available to each engineer's desk. The recording instruments are in the secretarial department. It is difficult to establish direct savings from the equipment, but we feel that there are many advantages. By having the dictating equipment easily available to each man, we feel that memorandums and letters, that might otherwise be overlooked or delayed, are written promptly.

"Previously, the engineers used their own cars for traveling when the airlines or trains were not satisfactory. We paid 10 cents a mile for use of the car. At the present time, we are operating a pool of 11 cars which we lease from a local dealer on a fee-plus-depreciation-allowance basis. After two years of this procedure, in which we have had a complete turnover of cars, our total cost has been approximately nine cents per mile. We feel that this transportation is much more reliable, makes a better impression on clients, and our personnel enjoy the prestige of driving a company car. There is a neat company nameplate on each front door. We initially used only station wagons but more recently have added two-door hardtops to the leased car fleet."

#### Cost Control Essential

Commenting on the problem of cost control, Norman R. Carson, senior executive engineer, R. W. Beck and Associates, Seattle, said, "One of the biggest problems in the operation of an engineering organization is maintaining control of costs in order to operate on a profitable basis. We do have a continuous check of each project each month through our cost accounting system to maintain control of our business operations. However, the control of costs is strictly a business rather than professional problem."

William T. Wright, of Kistner, Wright and Wright, Los Angeles,

pointed out that there is nothing like a close check on the progress of a job to keep costs at a minimum. "Years of experience," said Wright, "and monthly job cost records have given our firm sufficient data to be able to set a very close budget. Each section head schedules the man-hours allowed to match his budget and keeps a weekly check on the time spent.

"Our largest cost of operation is production time, and a continued check on this time is necessary. Weekly checks appear to be sufficient to advise supervisors as to the status of each project and to show up any deficiencies that develop in the schedule.

"Our brochure is a loose-leaf type put together in a plastic ring binder. This allows us to make changes readily and also provides a means of assembling special submittals for specific projects. We run our brochure on our Multilith machine which produces a product very close to commercial quality with colors to suit our taste. The results have been gratifying."

A. H. Koebig, of Koebig and Koebig, Los Angeles, has for the last three or four years been using the offset process for reports as well as a loose-leaf type of brochure. "We feel," he said, "that this method is quite a saving over the method we were using. Although we cannot calculate the direct amount of saving per month, we know it to be quite substantial. We feel that a firm of sufficient size can afford to put in the system and will get the same savings and benefits that we have experienced."

Lloyd K. Clark, of Clark and Groff Engineers, Salem, Oregon, reported that his firm kept a close check on costs as work progressed. "On each of our large jobs," said Clark, "we keep a monthly tabulation of time spent. This is broken down to man-hours of principals, office work, field work, and out-of-pocket expense. This record is maintained from our weekly time report using Hadley standard form



# FAIRVIEW

SPECIFIED BY THE WORLD'S FINEST ENGINEERS

DAY-BRITE LIGHTING, INCORPORATED  
ST. LOUIS 15, MO., SANTA CLARA, CALIF.

*Announcing*  
the New  
Jerguson  
**MAGNETIC  
GAGE**  
For Liquid Levels



An important advancement in liquid level observation for plants with dangerous explosive or inflammable conditions.

Safety design  
seals against  
escaping gases.

Measuring mechanism  
in stainless steel  
chamber.

Scale mounted outside  
chamber;  
magnetically  
actuated  
through chamber wall.

Distinct,  
accurate level  
shown in red  
contrasted with  
silver above.

Job designed,  
correlating pressure,  
temperature, and  
specific gravity.

Available with  
electric alarms.

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Write now for engineering sheet  
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Offices in Major Cities

In Canada: Peacock Bros. Ltd.

H605. This form, incidentally, fits our present system very well.

"We also estimate the general work schedule and time required. The balance between the estimate, the actual work record, and the income from the project gives us a pretty good record of how the project is paying out.

"We have learned, too, that offset printing is cheaper than type. Reproduction of photographs by certain offset methods is equal or superior to local printers' efforts."

#### Experience Important

Gerald R. Brunstrom, of Tracey, Cook and Brunstrom, Seattle, expresses the view that nothing takes the place of experience in the control of costs. "The problem of controlling costs in our organization," he said, "has grown along with the organization. We have attempted to hold our costs down by keeping tab on the jobs as they progress. For each job involving at least a month's work, we estimate the number of man-hours required to complete the job. Then we make a weekly summary and keep a running total of hours used. This figure is compared against an estimate of the percentage of work completed to show when corrective measures are needed. This system has its drawbacks in that the original estimate may be in error or the job may be running behind schedule. Experience is about the only way to make original estimates realistic."

This firm has an unusual brochure which was designed to cut costs and is sized to fit conveniently into a standard No. 10 envelope to be included with a transmittal letter. "The brochure," said Brunstrom, "has been kept brief, and is used mainly for initial promotional work. The cost of this brochure is low enough so that we can use it more freely than the standard book-type brochure."

Robert Kennedy, of Kennedy Engineers, San Francisco, had some interesting comments on the prob-

lem. "In common with all consulting engineering firms," he said, "we are caught between the rising cost of operations and the falling effective engineering fee which occurs because of the difference in the rate of rise of engineering costs and the construction costs on which percentage fees are based. The most direct relief from this squeeze is the use of new methods, tools, and techniques to enable each man to produce more. Some of these tools are expensive and only can be justified where they can be used intensively.

"We have found that the use of electronic computers does not require the purchase or installation of a machine but they can be used on a job rental basis. This makes calculation of water, gas, steam, and electrical networks a matter of minutes rather than days. Structural analyses also can be handled with ease. Machine programs also are being developed for storm flows and backwater curves.

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#### California Legislation

This has been a hectic session of the California legislature for those who have been trying to keep abreast of legislation affecting consulting engineers. Some particularly objectionable bills have been introduced at this session.

One bill would permit the use of the title, "civil engineer" by any employee of civil engineers or employees of people exempt from civil engineer registration. It would authorize any employee of a "registered civil engineer" such as clerks and draftsmen, to be called civil engineers. The bill has been or-



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dered held in committee, an action tantamount to killing the measure.

**Signatures, Seals, and Stamps**

An amendment to one section of the Engineers' Act would add a provision that prohibits signature, seals, and stamps for civil engineering plans except those of the civil engineer in responsible charge, or the public agency, or owner, indicating acceptance of responsibility for such agency. Another provision would include land surveying in the definition of civil engineering. The bill has been watered down by an amendment striking out the provisions relating to signature, seals, and stamps, and has been passed in amended form by both houses and forwarded to the Governor for his signature.

Another bill introduces technical amendments to the subdivision map act relating to the descriptions of curves in terms of chord bearings. This bill passed both houses and is now on the Governor's desk for his signature.

AB 692 would amend the Engineers' Act which authorizes the Board to enjoin violations or threatened violations. This bill added an injunction clause to the Surveyors' Act. It is in the hands of a subcommittee for a hearing. Both bills have been amended in a form that may make them inoperative.

**Mandatory Registration**

One new bill would provide for mandatory registration for electrical and mechanical engineers. There has been much opposition from such organizations as the Committee on Engineering Laws, electrical and plumbing contractors associations, the airplane industry, the Designers, the Home Builders Council, and others. The bill was referred to a subcommittee for study and submission of amendments. It is reported that the subcommittee amendments would strike out everything in this bill except the definition of "electrical and mechanical engineering." If

this is done, the professions are back where they started, except that the definition will be transferred from the Board's rules to the Act itself, if the bill passes.

AB 1904 is a bill that would create a State Board of Building Designers. It has come up for a hearing, and has been referred to a subcommittee for study. There is another bill that would create a similar Board.

SB 101 amends the Architects' Act to provide that anyone may use the term "designer" or "building designer." It has been amended to provide that a Designer must, in addition to using the term Designer, also state that he is not an architect.

SB 677 would make architects and civil engineers responsible for plans which they prepare and prohibit delegation of this responsibility. It has been reported out of the Senate committee with the recommendation that it be referred to an interim committee for study.

**Oregon Legislation**

Consulting engineers in Oregon fared reasonably well in the 1959 legislature, said Harry Czyzewski, chairman of the Legislative Committee of the Consulting Engineers Association of Oregon. He gave much of the credit for this satisfactory outcome to Lloyd K. Clark, who was chairman of the Legislative Committee of the Professional Engineers of Oregon. Of nine bills opposed in whole or part, only three were passed by the legislature, and two of four bills given full approval by the committee were enacted into law.

**Engineer-In-Training**

SB 214, establishing the engineer-in-training classification, by amendment to the Engineering Registration Act, was passed, as was SB 118, an act to re-establish the right of engineers to give advice on finance with regard to the design and construction of public works. This bill, approved by



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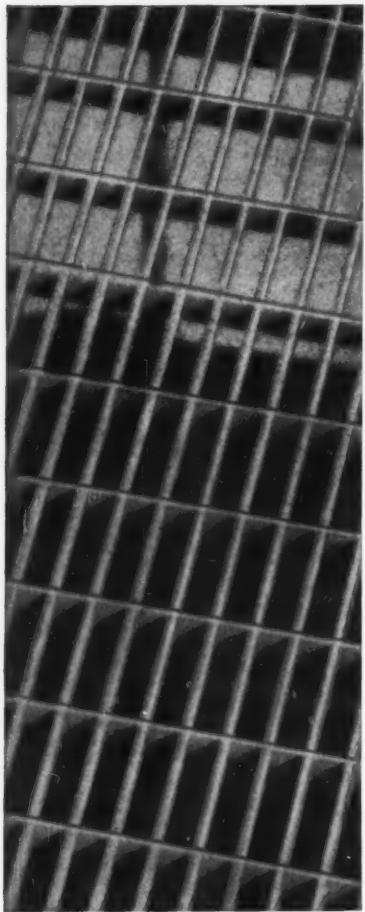
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CEAO, will restore this normal function of the engineer which apparently was outlawed by a bill passed by a previous legislature.

SB 417 established a Boiler Code and an advisory board. It was passed, but without CEAO proposed amendments that would have strengthened the technical capacity of the advisory board. SB 213, which established an Electrical Code and an advisory board, was similarly passed without proposed strengthening amendments.

HB 138 would force all state employees, including professional employees, to bargain collectively through union representatives. The bill was passed after bitter opposition, but has not yet been signed by the Governor. CEAO opposed the bill on the grounds that there was no provision to protect professional employees from being submerged by, and represented by, a nonprofessional employee union.

#### Collection of Fees and Bad Debts

At the San Francisco CEAC meeting in May, Robert T. Lawson, of Dames and Moore, commented on a perennial problem of consulting engineers. In renegotiating engineering work, Lawson stressed the necessity of defining scope and fee in terms that are understood by both parties. Once a contract is made, the engineer should not exceed the scope without a commensurate increase in fee. If the scope is reduced, it is possible that the fee may be reduced. A written contract is not a cure-all but frequently will avoid fee difficulty. The contract does not have to be lengthy or complex, but it should cover the scope, fee, terms of payment, times of performance, and any contingencies that can be foreseen.

To cope with a difficult collection situation, Lawson said that the engineer should first establish in his own mind the reason for the difficulty. Unforeseen complications or contingencies that were not contemplated in the original scope may have caused an increased fee

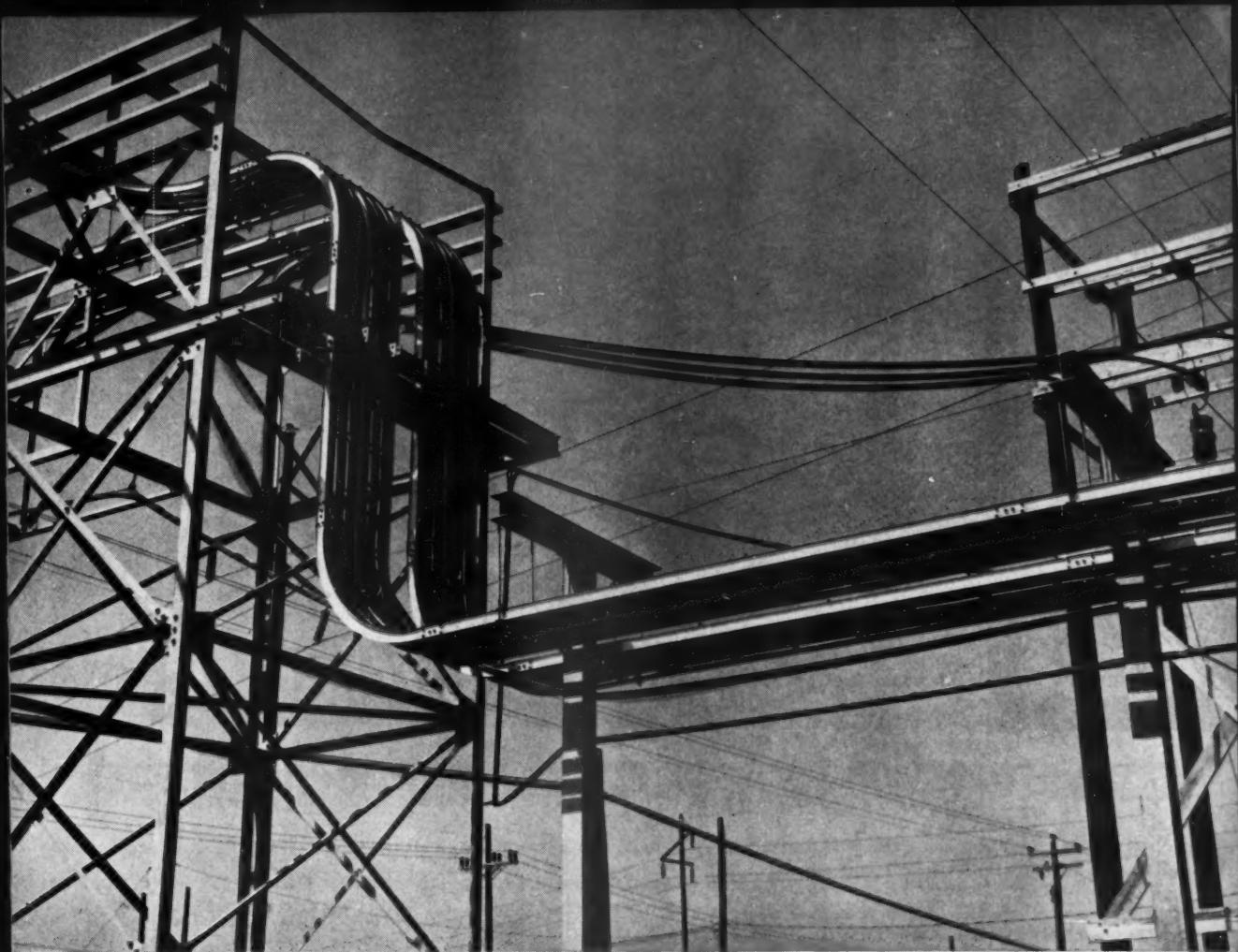
and led to subsequent difficulty in collection. There also is the client who is a plain and simple chiseler. These situations can be handled in several ways. One is to absorb the amount of fee in contest. This makes the client feel good, but the engineer will go broke if he does it often. The client can be sued, or the services of a collection agency may be employed. It is usually best, however, to renegotiate with the client and try to arrive at an understanding or compromise.

If renegotiation is handled with skill, Lawson pointed out, it may be possible to continue to do work for the same client on a much improved basis. Even if the client is lost, the incident should be reviewed to learn what might be done better by the engineer on similar types of work to prevent fee trouble. Occasionally the engineer may learn that it would be wise not to serve a particular client on any future work. □

#### ARTICLE REPRINTS

For free copies of reprints listed below, write on company letterhead to Reader Service Dept., CONSULTING ENGINEER 217 Wayne St., St. Joseph, Mich.

- "Where to Use a Curtain of Air"
- "Mass Rapid Transit for Super Cities"
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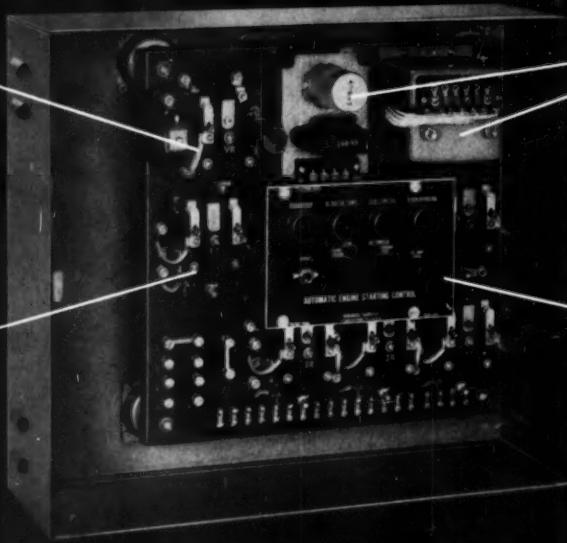
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Can operate from single pole contact on automatic transfer panel or control station.

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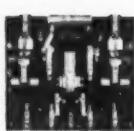
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Eliminates guesswork in connecting engine and starting panel; simplifies installation.

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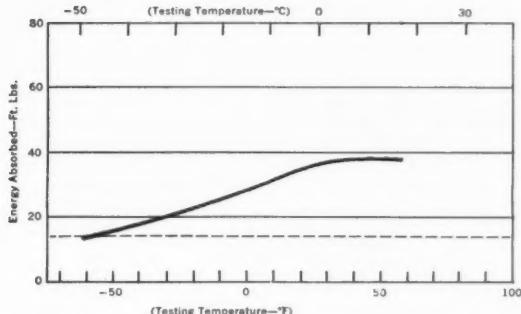
New Mn Wrought Iron is not a substitute for 4-D Wrought Iron. Mn was developed *specifically* to meet critical engineering needs for a tough, yet economical metal in low temperature services where the possibility of brittle failure poses design problems.

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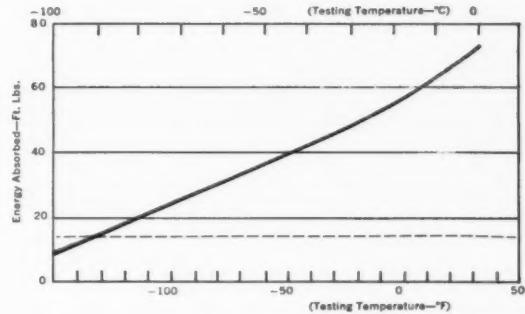
Mn Wrought Iron costs *less* initially than many of the low alloy steels recommended for low temperature service. Available in pipe, plate, and other forms, this new material is well suited for a wide variety of low temperature applications, including such services as tanks and process piping in the refrigeration and petrochemical industries.

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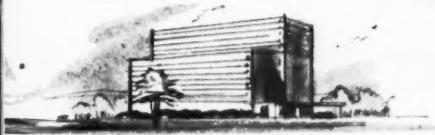
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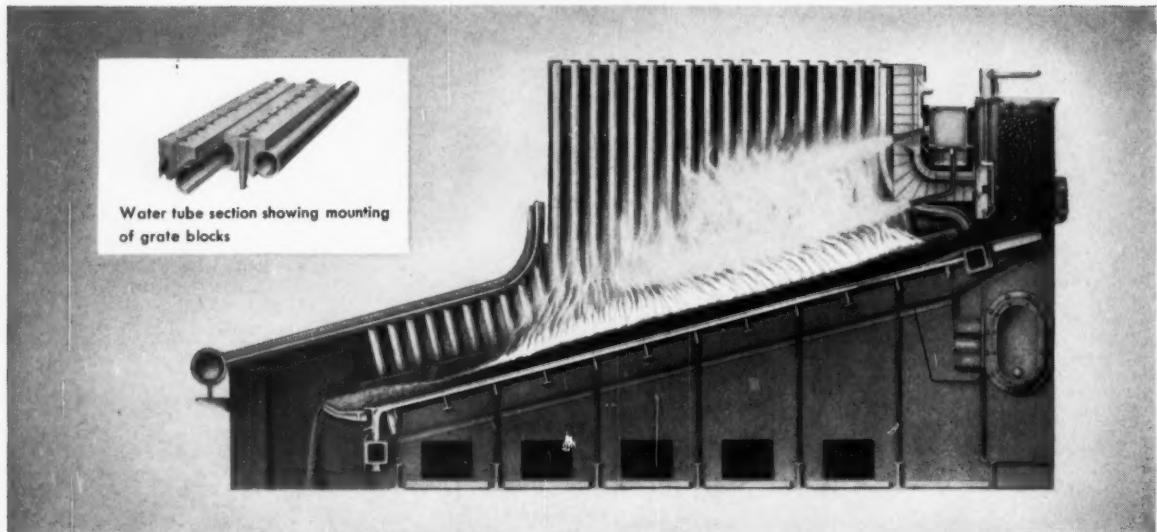
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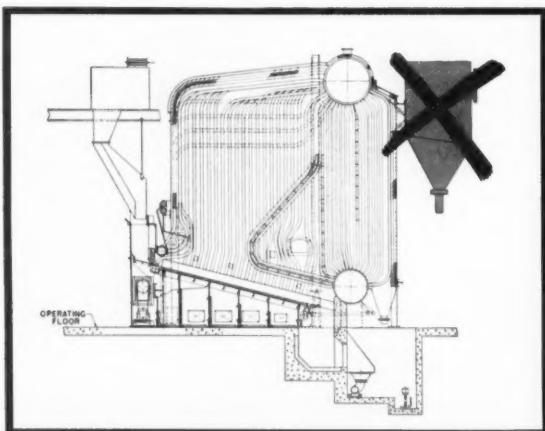
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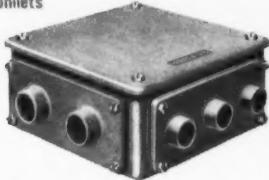
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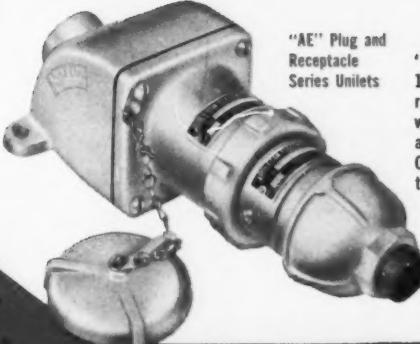


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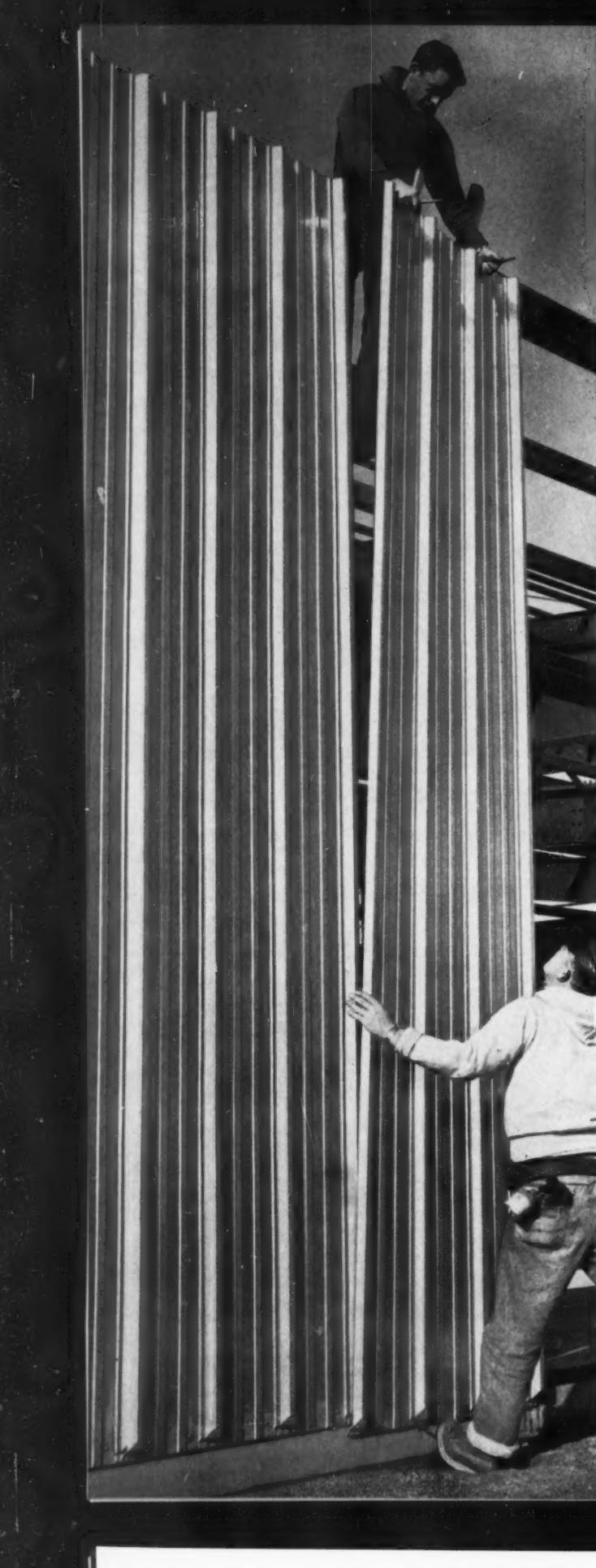
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# The Legal Aspect

MELVIN NORD, P.E.

Consultant in Legal and Technical Problems  
Patent Attorney

## The Law of Real Property: Highways

A HIGHWAY is defined as a way open for the use of the public at large without distinction, discrimination, or restriction, except such as is incident to regulations calculated to secure to the general public the greatest practical benefit from and enjoyment of said public way. The prime essentials are the right of common enjoyment by the public, and the duty of public maintenance.

The term "highway" is a generic one, and it includes all public roads, streets, and ways. Normally, of course, a highway leads from one public place to another public place, but this is not an indispensable requirement; a cul-de-sac may be a highway.

A highway may be regarded as an easement of perpetual character, or as land owned by the public. The first view is preferred.

### Establishment of Highways

Highways may be established by prescription, dedication (see "The Legal Aspect," CONSULTING ENGINEER, June 1959), or under statutory proceedings.

For a highway to be established by prescription, a specific way must have been used continuously and uninterrupted by the general public for a certain period (e.g., ten years). The use must be accompanied by some act on the part of the public authorities which is open, notorious, and hostile to the private ownership, thereby in ef-

fect giving the original owner notice that his title is denied. Permissive use is not sufficient.

Statutes also can provide methods for establishing new highways, and they generally include the setting up of highway commissions or boards. The land is acquired by the exercise of eminent domain — by condemnation proceedings and the payment of just compensation for the land taken.

### Vacation and Abandonment

Statutory procedures generally are provided for altering or discontinuing highways.

In addition, a highway may cease to be such by abandonment and nonuse. When it has been replaced by another highway and has ceased to be used for a sufficient length of time to indicate acceptance by the public of the new highway, the old one is regarded as abandoned. Where no new highway has been established, abandonment generally will not be held to have occurred until the lapse of the period necessary for title to have been acquired by the individual by adverse possession (usually 20 years).

When a highway is vacated or abandoned, title reverts to the abutting owners, in accordance with their original rights in the land.

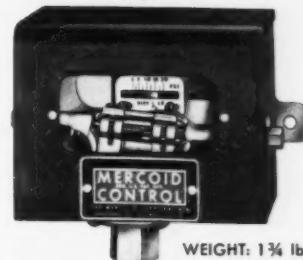
### Construction and Maintenance

The public has the duty to maintain its highways. Each state has

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INTERNAL WIRING CONNECTIONS: 3 post terminal block.

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WRITE FOR BULLETIN 02

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statutes that govern the way in which construction and maintenance of highways is carried out, and that stipulate the rights and duties of various state, county, and municipal authorities. In addition, provision is made for the construction and maintenance of ditches and drains to drain surface water from highways.

Methods for letting contracts by public bidding and for levying taxes to provide funds for highway

construction and maintenance also are regulated by statutes. Gasoline and weight taxes generally are allocated for such purposes, along with other sources of revenue.

#### Regulation and Use of Highways

One of the most ancient types of public nuisance is the unauthorized obstruction of or encroachment upon a public highway. A public nuisance is a minor crime, a misdemeanor, and also may re-

sult in civil liability in tort to any individual who suffers special injury distinct from that suffered by the public generally. In addition, any citizen is authorized to abate a public nuisance if he can do so without committing a breach of the peace.

Use of the public highways also is subject to the police power of the state. Under this power, the various traffic regulations, for example, are adopted.

#### Liability for Injuries

Although the maintenance of highways is, in principle, a governmental activity which would provide municipal corporations with immunity from tort liability for injuries caused by defects or obstructions in highways, statutes uniformly alter this rule. Under these statutes, liability usually is placed on municipal corporations for their negligence, where there has been no contributory negligence by the injured persons. These statutes generally require that notice of the injury be given to the municipal corporation within a short time (e.g., 60 days after the happening of the injury).

In order to show negligence, it generally is necessary to establish that the municipality had notice of the defect. However, if the defect has existed for a substantial length of time, actual knowledge by the municipality of the defect need not be shown. In fact, statutes sometimes provide a specific time beyond which notice of the defect is conclusively presumed. □



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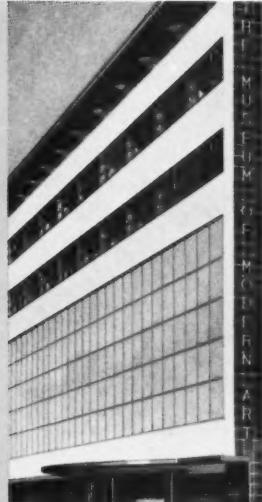
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# *In the World's*



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is the third largest life insurance institution. In 1959 it is celebrating its 100th Anniversary by erecting a new 42 story headquarters building 546 feet high.

With 1,700,000 square feet of floor space it will be the world's largest single occupancy private office building. It is adjacent to New York's Rockefeller Center located on Avenue of the Americas between 51st and 52nd Streets.

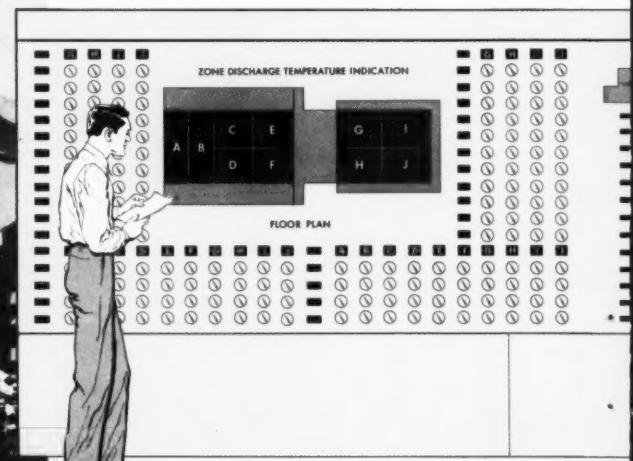
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Below: Part of the 37 foot long Powers multi-colored control center that will play an important role in efficient supervision and regulation of the 55 air conditioning systems and 19 ventilating units



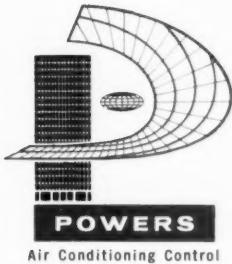
Temperatures at key points will be shown continuously by easy-to-read pneumatic temperature gages.

NEW EQUITABLE LIFE ASSURANCE SOCIETY BUILDING  
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# Largest Single Occupancy Tower

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*will regulate the Climate of Progress*



Air Conditioning Control



5772 Induction type Air Conditioning Units

- Proper Thermal Environment for 10,000 employees in its new \$58,000,000 headquarters building is important for Equitable's continued growth and progress.

Year-round air conditioned comfort assured by a Powers Quality System of Temperature Control will help provide the climate conducive to better thinking, better planning and increased productivity of employees.

Around 75 Million cubic feet of conditioned air per hour will be circulated through 55 central systems. 5400 Tons of refrigeration will be provided by 4 centrifugal steam turbine driven compressors.

Perimeter areas will be equipped with 5772 induction type air conditioning units, supplied by 12 air conditioning systems. Powers Heating-Cooling Thermostats controlling PACKLESS Valves will enable occupants of each space to select the temperature desired. Interior areas with moveable partitions to permit rearrangement of rooms if required, will have zone controlled air conditioning supplied by 43 central systems.

Powers Series 200 Temperature Regulators and Submaster Regulators will be used for precision control of all air conditioning.

**POWERS Graph-O-Matic Control Center**, 37 feet long, will provide the nerve center for all temperature, humidity and ventilation control systems. Temperatures throughout all the systems are pneumatically transmitted to this center, and the operator is provided with adequate means for re-setting the control instruments located hundreds of feet away.

**In Your New Building** — make sure you get the maximum return on the investment in air conditioning. Ask your architect or consulting engineer to include a time proven Powers Pneumatic Air Conditioning Control System.

**Powers Complete Responsibility** for a correctly engineered control system, proper installation, successful operation and **SERVICE** when required, are your best insurance for dependable year after year performance.

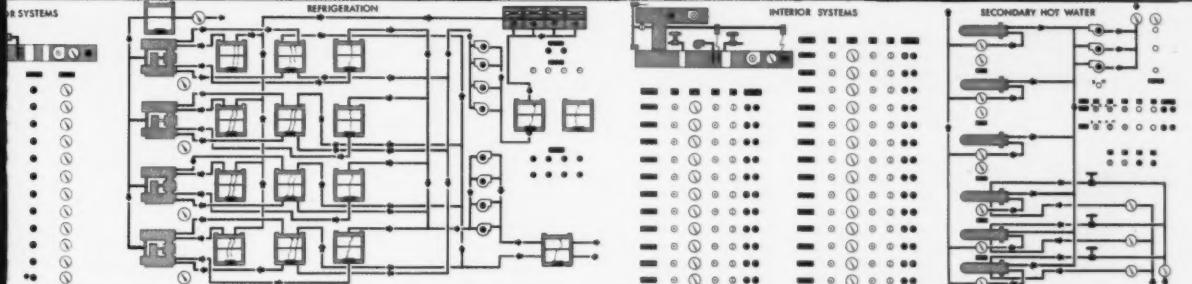


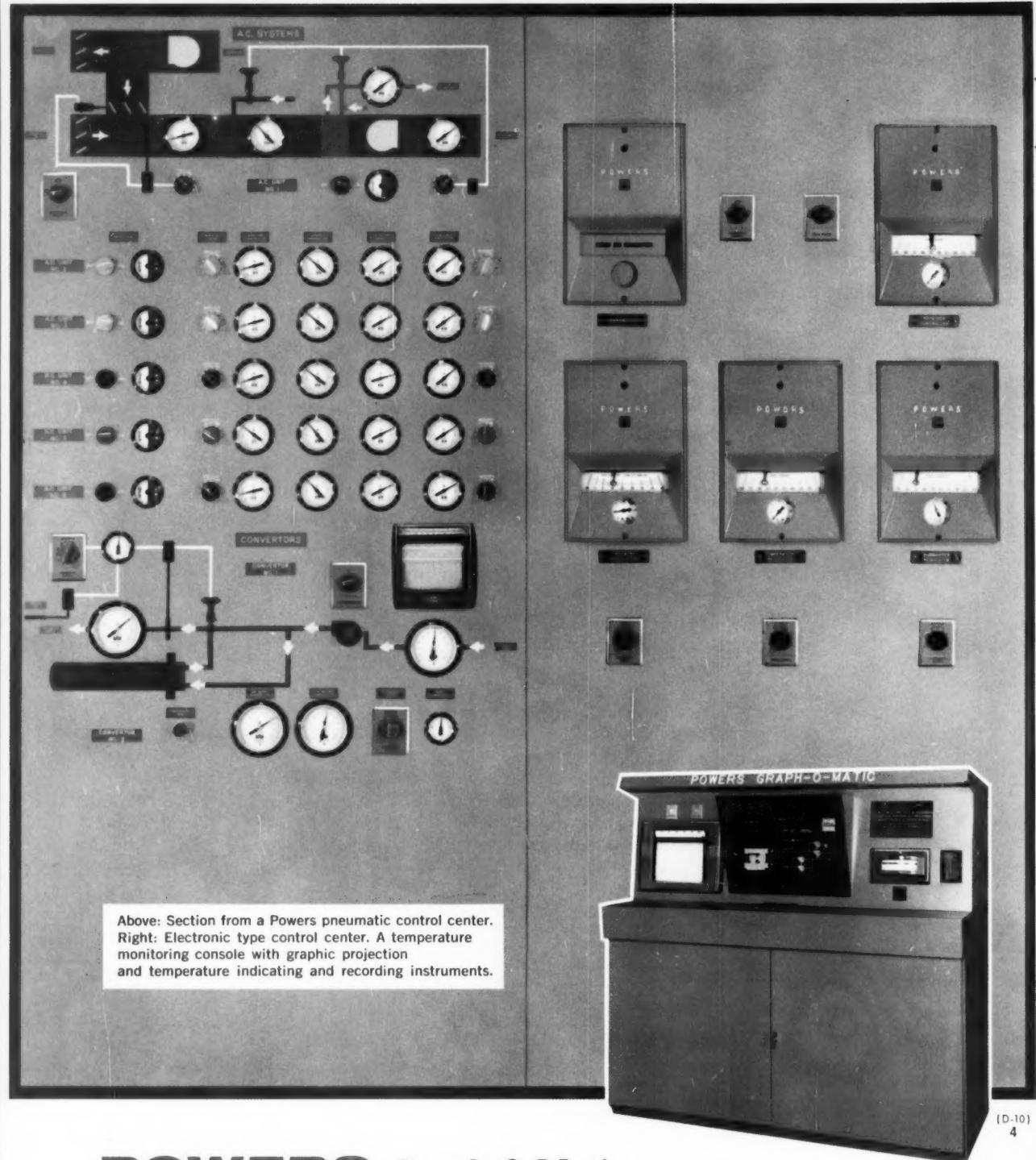
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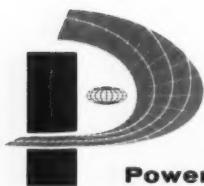
### POWERS GRAPH-O-MATIC CONTROL CENTER





Above: Section from a Powers pneumatic control center.  
Right: Electronic type control center. A temperature monitoring console with graphic projection and temperature indicating and recording instruments.

## POWERS *Graph-O-Matic* Control Centers



**Powers Air Conditioning Control Systems Regulate the Climate of Progress**

combined with a Powers Quality System of Temperature, Humidity and Ventilation Control, provide the ultimate in indoor climate or process automation. • Graphic panels are custom designed to meet the requirements of each installation. Instruments on pneumatic control panels perform many functions. Temperatures at key points throughout a building are indicated continuously and permit engineer to start, stop, supervise and regulate all equipment without leaving the panel.

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# **DETROIT ROTOSTOKER C-C** (Continuous Cleaning)

**In any test you  
want to apply  
DETROIT  
ROTOSTOKER C-C  
(Continuous Cleaning)  
will stand out**

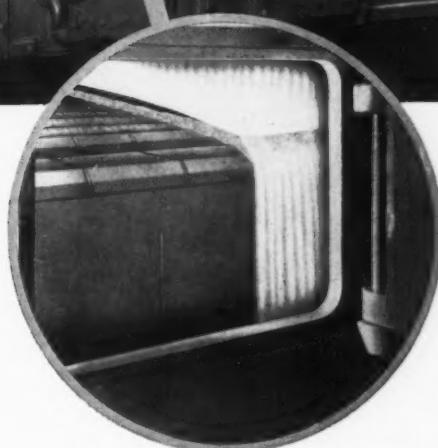
Detroit RotoStoker C-C (Continuous Cleaning) with reciprocating grates that continuously clean the fire and discharge ash at the front, where it may be taken from the ash pit at floor level if desired, avoiding need for a basement ash bunker. High sustained efficiency, high availability, low power for operation — For boiler capacities from 5,000 to 75,000 pounds steam per hour.



Efficiency, availability, flexibility under fluctuating load, ability to burn good or low grade coals or waste materials, durability, low parasite power consumption and low maintenance. RotoStoker C-C scores high on all points.

Among those who have tested the RotoStoker C-C — found it a winner — are such well known names as:

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RotoStoker C-C is typical of the Dependable Detroit Line which includes stokers for efficient firing of boilers from 3,000 to 400,000 pounds per hour steam capacity.

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B&G circulating pumps, from the 1/12 HP Booster to the new 40 HP Universal are specialized units! They are designed and built specifically to serve the exacting needs of circulated water heating and cooling systems...ideal for applications of the B&G-developed principle of primary and secondary pumping.

Quiet, vibrationless operation is the outstanding characteristic of B&G pumps. They can be installed without expensive flexible connections or noise dampeners of any kind.

Among the features which assure both quiet operation and long-lived dependability are specially built, more costly motors, tested for quietness—oversized shafts of hardened alloy steel—long sleeve bearings—noise dampening spring couplers—oil lubrication and leak-proof mechanical seals.

That's why B&G Circulating Pumps, small or large, are *preferred*...they're *quiet where silence is a "must"!*

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**erases \$10,615 a year  
off the cost of erasers for  
Venus Pen & Pencil**

Venus Pen & Pencil Corp. now produces better erasers—and saves \$10,615 a year besides—by using a Chrysler Liquid Chiller to supply cool water for the rolls used in calendering the rubber.

The rolls must be kept from overheating to prevent discoloration or damage to the rubber. Venus Pen & Pencil had been using city water in its Lewisburg, Tenn., rubber plant. Water costs ran nearly a penny per pound of processed rubber. And, since water temperature rose too high in summer, 10% of its production was wasted.

The Chrysler Liquid Chiller solved the production problem by keeping recirculated water at a constant 50° F. Eraser quality improved... and \$9,000 worth of waste rubber per year was eliminated. Water costs were cut almost 75%—saving \$3,550 annually. And maintenance costs on the rolls dropped \$500. Net savings of \$10,615 in the first year practically paid the entire cost of the Chrysler Liquid Chiller installation.

Where chilled water is required for cooling a process, or cooling for comfort, Chrysler equipment offers many exclusive advantages: Hermetically sealed Radial Compressor, innerfin direct expansion chiller, lower installation and maintenance costs. Get the complete story and technical data from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corp., Dept. X-79, Dayton 1, Ohio. In Canada: Therm-O-Rite Products, Ltd., Toronto, Ontario.



**FIRST WITH THE FINEST IN AIR CONDITIONING**



## Heard Around Headquarters

THE Consulting Engineers Association of Michigan, only Consulting Engineers Council member yet to merge with a functional section of the National Society of Professional Engineers, was congratulated at its first annual meeting by CEC President Ralph Westcott.

Admitting that he, as well as a majority of the board members, were a little skeptical of the proposed merger plans presented last fall at the Dallas board meeting, Westcott said he had been very pleased to observe how the cooperative effort was working.

"I was wrong in thinking such a merger could not work. Now that you are organized, it is up to you to set the pattern. If your organization works out well, who knows. It might set a precedent for others. I assure you the Consulting Engineers Council will do nothing to discourage you in your combined efforts," Westcott added.

Speaking at the CEAM banquet, Westcott said it would be easy for the CEC to turn into a "mutual admiration society," solving none of its problems in the process. Instead, he urged engineers to step forth and be counted, accepting the responsibility for correcting their own short-comings instead of always blaming their troubles on the other fellow.

How can the consulting engineer get higher fees? Earn them!

"First, the responsibility is ours. When we take an assignment we should seal the fee in an envelope, put it in our safe, and forget it. Then do the best job possible. The architect, and the client, will recognize the quality of your work, and you will have a basis for any future discussions that might become necessary on higher fees."

Westcott suggested the consultant "look in the mirror, and quit blaming others for your troubles. As our engineering improves, so will our fees." Often those who complain the loudest about fees are the men who take what fees they can get, then do even less work than the small fees warrant.

What about "free engineering?" Westcott does not think it is here to stay.

If a number of contractors are asked to submit designs and bids on a project, four out of five of the designs never are used. This waste is expensive to the contractor. When manufacturers do the design, the "free engineering" is paid for by increased product costs. It is only when a client goes to a consulting engineer that he has a representative for his interests. And the client should see to it that this representative also su-

pervises the construction to see that the specifications are met.

"We can throw rocks at contractors and engineers, and get rocks thrown back at us — or we can work together. The consulting engineer needs to cooperate with the manufacturer for improved products in the future. And he needs the improved construction methods that can come from intelligent and cooperative joint efforts with the contractors," the CEC president concluded.

In line with this, Westcott said he has high hopes that a future policy statement will be forthcoming from the Producers' Council recommending that project design belongs in the hands of the consulting engineer.

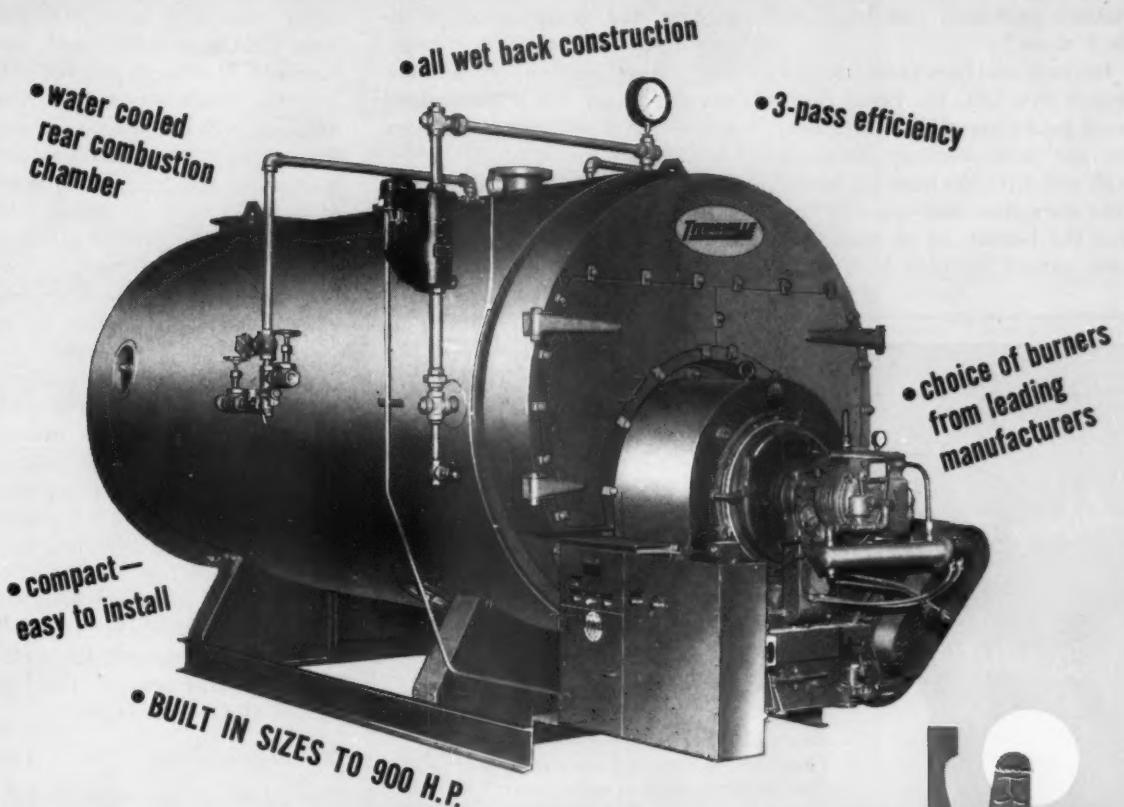
Often, architects are accused of making "second class citizens" of consulting engineers. He suggested the engineer take the initiative in such situations and ask what they can do to improve the working climate. ("We're not always the ones who are right in these situations, you know.") The architect probably will be so thrown off-guard by this offer that the situation will wind up with both the architect and the engineer "giving" a little.

The viewpoint of the architect was directly represented at the CEAM meeting, with American Institute of Architects President John Noble Richards serving as the luncheon speaker.

"Before Detroit could fill the demand for a car or two for every American family, the automobile industry had to be revamped, reorganized, and modernized," Richards said. "But . . . even the glistening new skyscrapers which adorn Park Avenue, and most certainly our new housing developments in the suburbs, are still put up by essentially the same methods Romans used some 2000 years ago.

"So where do we begin? In a small way you and we began — perhaps belatedly — a few months ago when you of the CEC and we

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of the AIA started to get together. The job requires teamwork. We require specialization. But no specialized profession can begin to do it alone."

Richards said he was encouraged to note that CEC has joined Engineers Joint Council. "As you know, we are now working extremely well with EJC. We have a splendid joint committee and you will find that the benefits of its work will soon extend to you, both as a

group and as individual consulting engineers."

During the CEAM membership sessions, the group voted to increase dues, added six new members, elected new officers, and announced plans for a comprehensive roster of consulting engineers in Michigan.

The finance committee announced proposed dues of \$75 per member. Of this, \$50 would be paid to the Consulting Engineers

Council and \$25 retained for CEAM. It was explained that a profit of \$1500 is expected from the roster. This is to be a listing of both CEAM members and non-members, in order to give the public a list which is complete. Non-members will be charged for anything more than a small-type one-line listing, and most are expected to purchase the larger blocks similar to those provided without charge to CEAM members.

A motion from the floor suggested that CEAM dues be increased to \$100 per member.

After a member of the audience paid his dues so a quorum of qualified members would be present, the motion to increase dues (starting in January 1960) was passed.

Louis E. Winkelhaus was elected president, to succeed John R. Snell. Other new officers are John W. Kushing, vice president; Fred Von Voigtländer, secretary; George T. Crothers, treasurer; and Karol Piotrowski, F. Spencer Weber, and Robert H. Gove, directors.

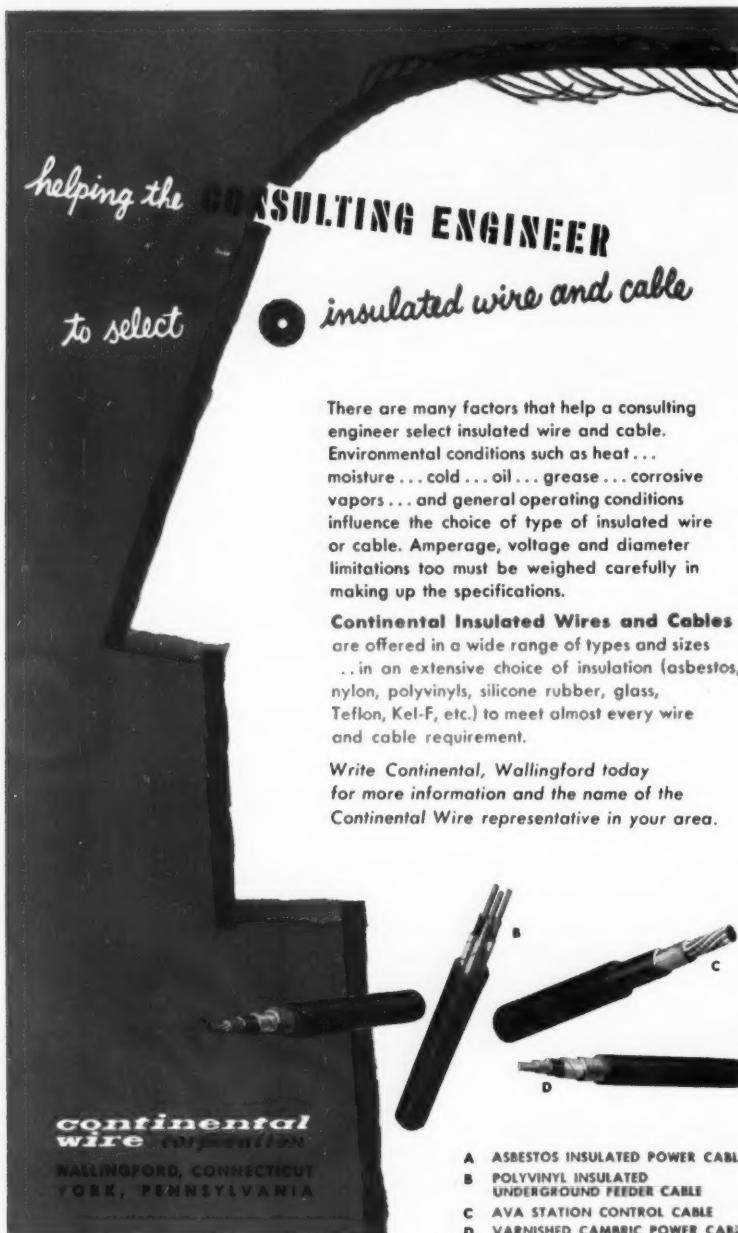
#### To Keep Modern

The American Society of Civil Engineers has decided to make sure that its divisions are in tune with the times. At future annual conventions, the divisions will be reviewed with the idea of possible boundary changes. Each division will be scrutinized every 10 years, on years evenly divisible by 10, or more often if the Board thinks it is needed.

#### "Force Majeure"

A West German engineer, H. Werner Knauff of Farbenfabriken Bayer, Leverkusen, warned Westerners at a recent meeting of the American Institute of Chemical Engineers about making agreements with Communist countries.

"Of course, acts of God do not occur in a Communist country. In Western countries, since a private company cannot be held responsible for acts of its government over which it has no control, acts of gov-



*helping the*  
**CONSULTING ENGINEER**  
*to select*  
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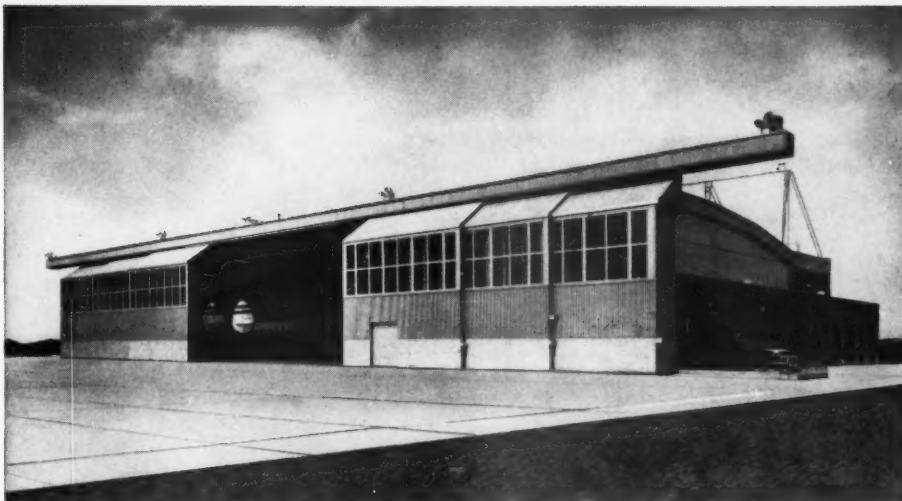
There are many factors that help a consulting engineer select insulated wire and cable. Environmental conditions such as heat... moisture... cold... oil... grease... corrosive vapors... and general operating conditions influence the choice of type of insulated wire or cable. Amperage, voltage and diameter limitations too must be weighed carefully in making up the specifications.

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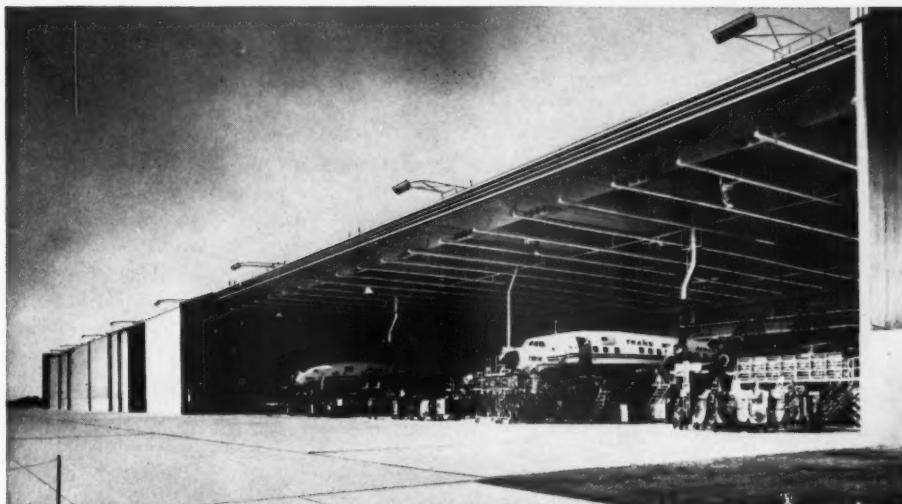
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## Whatever Hangar Door Opening is Required

... BYRNE SUPPLIES IT

Obviously, the space requirements for hangars at different airports vary considerably. In all cases, however, there is the constant need for hangar doors which provide complete weather-tight closure . . . smooth, trouble-free operation . . . and minimum maintenance. And it is in Byrne doors that such requirements are always met regardless of the size of the hangar or its type of construction.

In the two hangars illustrated, for example, there is considerable difference both in size and structural design. Both, however, are equipped with Byrne doors . . . in Philadelphia, providing a door opening 276 feet wide by 46 feet high . . . in Kansas City, 814 feet wide by 51 feet high. The same door design principle—with a

slanting portion hinged to the top of the door to provide compensation for the specified building deflection—was applied in each installation.

If a hangar design is on your boards—or will be in the near future—you'll find it well worth your while to consult Byrne engineers now. You'll get the benefit of more than 30 years' specialized experience in the development and manufacture of hangar doors.

**BYRNE doors, inc.**

1603 E. Nine Mile Road, Ferndale, Detroit 20, Michigan

101 Park Ave., New York 17, N. Y. • Cafritz Bldg., Washington, D. C.

Byrne Doors, Ltd., 381 College St., Toronto 2B, Ont.

MEMBER OF THE HANGAR AND INDUSTRIAL DOOR TECHNICAL COUNCIL

ernment are generally considered as a case of force majeure. A Soviet arbitration court has also held that acts of the Soviet government are to be considered as force majeure.

"In such a case, since, for all practical purposes, the Soviet government and its 100 percent owned company are identical, this formal approach is an injustice to the other party. If the government or the company does not want to fulfill the contract, the government orders

the company not to fulfill it and consequently the licensor is entirely at the mercy of the Soviet government. In addition, since a strike is, in their ideology, a legitimate defense of the working class against exploitation by the capitalists, a Communist partner will also refuse to regard a strike as a case of force majeure. This is very important if the Western partner has to agree to supply not only know-how, but also machinery with fixed delivery

dates carrying fines or cancellation of the contract for failure to perform on time.

"Russia has accepted the rulings of foreign arbitration courts in many cases and at present prefers an arbitration court at Stockholm," Knauff added.

#### A Bit of Introspection

A mid-year appraisal of the New York Association of Consulting Engineers shows a change in the membership basis, completion of incorporation proceedings, and elimination of much committee inertia.

For the first time, the Association (formerly limited to consultants in the building trades) has opened its membership to any engineer in private practice. "It is my personal belief that if we are going to grow and represent the consulting engineer here in New York, we need these people. Furthermore, establishing our membership on a broader basis should greatly expand the Association's influence," said John F. Hennessy Jr., president.

The New York Association, which dates back to 1924, now is incorporated. "This is a step which had been considered for a number of years in order to remove any member's personal liability for a group action," Hennessy added.

Early this year, questionnaires were circulated asking Association members to volunteer for committee work. Evidently, the system worked well. The 13 committees have 86 members, who hold regular monthly meetings at the Association office.

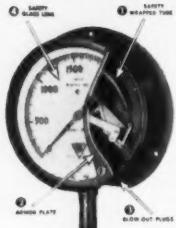
Among the new groups is an education committee. "We have realized for some time that the average engineering graduate knows little about the consulting engineering profession, and the advantages of working for an engineer in private practice," Hennessy said. "We want to see that the top men in the classes at least know what we have to offer them."

Association members who are alumni of the seven metropolitan

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### ENGINEERING DATA • SELECTION INDEX

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engineering colleges are arranging to distribute educational material at their schools.

Association members also have been quite vocal this year on national and state legislation. Group and individual telegrams were sent to the proper representatives opposing corporate practice, portions of the Kennedy-Ervin labor reform bill, and the Interior Department appropriations amendment limiting the fees of consulting engineers.

Approval also was given to the Keogh-Simpson self-retirement bill.

"We feel strongly that our legislators cannot properly represent the engineering profession unless we make our needs known. We have received replies to almost 100 percent of the telegrams we have sent," Hennessy added.

And the Association has taken an active interest in New York City departments. When Comptroller Lawrence E. Gerosa declared that

engineers and architects were being overpaid for design work and that this caused widespread waste in school construction, the Association sent a letter of protest. The Association, in cooperation with the New York Chapter of the American Institute of Architects, also detailed an answer to Gerosa's charges. A report to Governor Rockefeller later included some of the Association's suggestions.

A comprehensive survey of the employment practices of members currently is being compiled. It will be complete by September.

What changes are planned in Association activities during the remainder of the year? "We plan to continue our committee work, gradually expanding our current projects," Hennessy said. "About the only change will be in the meetings. Starting in September, we will have speakers for half the gatherings and limit our business discussions to the other half."

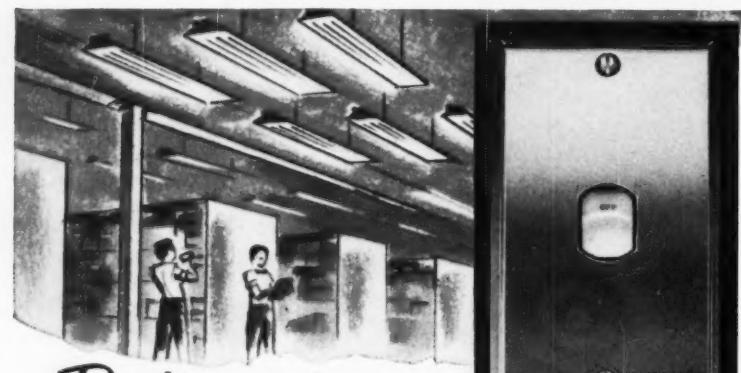
#### Corporate Practice

Results are trickling in from corporate practice bills throughout the nation. In addition to activity in the various states, Federal legislation (two identical bills) is pending. If either of these bills pass, the government will have the specific right to hire engineering corporations. In the state legislatures:

*Alabama* — A bill has been introduced which would require 60 percent of the ownership of any corporation doing business with the state to be licensed engineers in Alabama. This has been referred to committee.

*Colorado* — Corporate practice has been legal, providing the persons in charge of design or supervision are registered engineers. However, a bill making minor revisions in the law has been passed and signed by the governor. This merely reaffirms the status of corporations.

*Hawaii* — Currently, corporations and partnerships are allowed to practice engineering. A rather unusual bill, which would not allow



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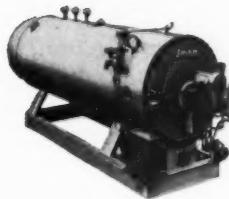
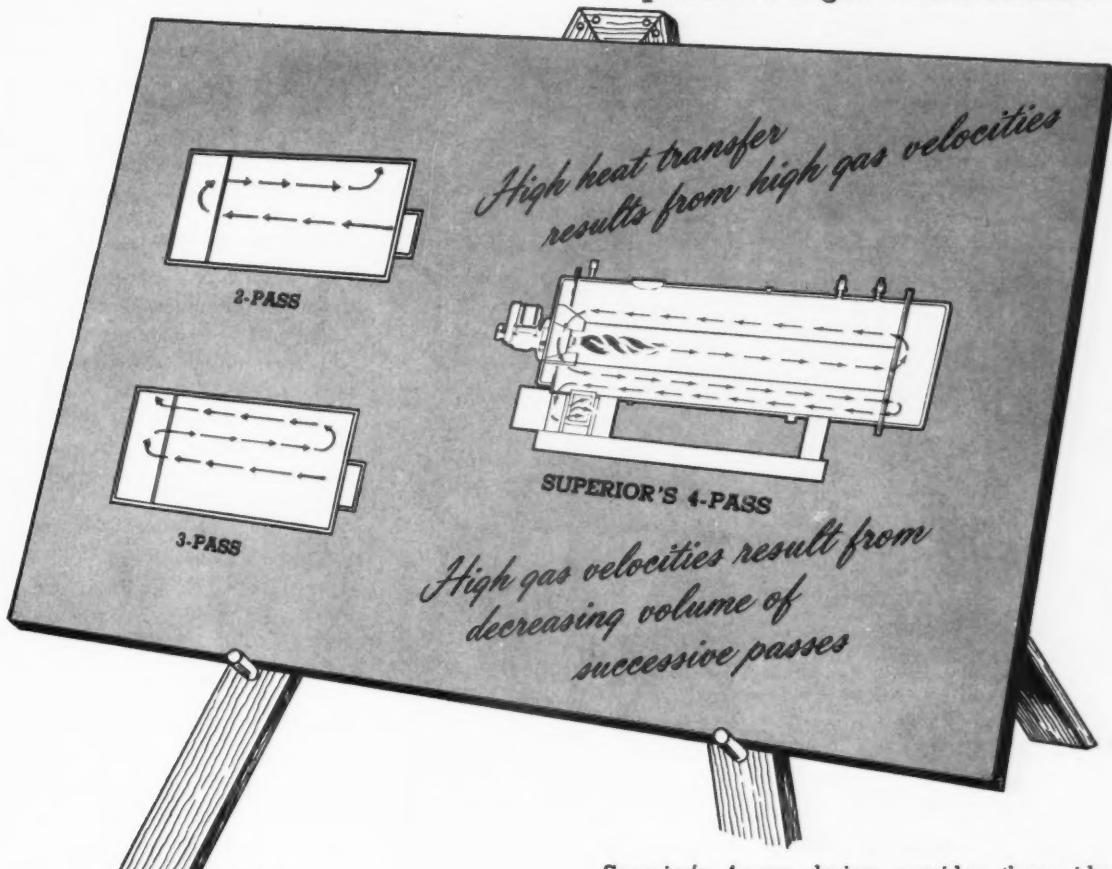


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corporations or partnerships to practice, has been defeated.

**Washington** — At press time, the corporate practice scene still smoldered. A "trial bill" allowing corporations to practice for two years, provided those in responsible charge are registered engineers, was passed in the recent legislature. Those opposing corporate practice needed more than 45,000 verified signatures by June 10 in order to put the issue before the

public. There is much dissension in the engineering ranks in the State of Washington.

#### To Upgrade Registration

The New Jersey Society of Professional Engineers is backing a revision of the registration laws aimed at upgrading the requirements for an engineering or land surveying license. The revision would reduce the number of provisions for exemption, facilitate administration

of the law, and increase application fees to cover the increased costs of administration.

The bill specifically provides that all partners and principals of unincorporated firms using the words "engineers, engineering, surveyors, land surveyors, or surveying," in their titles must be licensed in the State of New Jersey. Corporations must continue to have all persons in responsible charge licensed.

#### New York Schools

New York City Comptroller Lawrence E. Gerosa's accusation of waste and poor planning in school construction, has resulted in another study. This one was conducted by top educators appointed as a committee at the request of the State Education Commission. Earlier, a Professional Advisory Committee, representing the New York Association of Consulting Engineers and the New York Chapter of the American Institute of Architects, detailed an answer to Gerosa's charges.

In a discussion of "Private Architect's Fees" (the educators lumped engineering with architecture throughout), the latest report began with a comment on Gerosa's contention that architects were paid higher fees for schools than for the design of other public buildings. It was not disputed by the Board of Education that fees paid to outside architects for school design have been higher than fees paid to architects for other types of public buildings. However, the report explained that this is like comparing apples and bananas.

Presently, architects are selected from a panel of about 300 names approved by the mayor. A fee is fixed during preliminary negotiations. After a resolution by the Board of Education approving the selection, the matter is referred from the Board of Estimate to the Budget Director. He then calls in the architect for a renegotiation. Sometimes the Comptroller's representative participates in this dis-



West Ridge School, Greece, N.Y. • Architect: Benedict Ade—Rochester  
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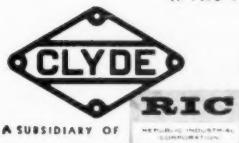
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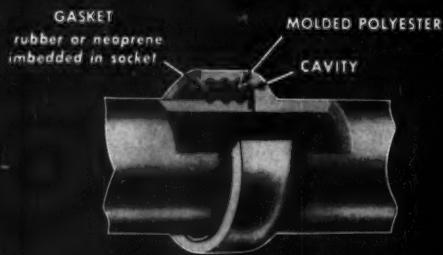


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cussion. After everyone is finished, the architect is re-referred to the Board of Estimate for approval. This system was termed "obviously unsatisfactory."

So a committee representing the Board of Education, the Budget Director, and the Comptroller has met and drafted standardized fees. It has been suggested that this schedule be kept secret. The committee investigating Gerosa's charges questions the wisdom of the proposed secrecy, and suggests that private negotiations up to a ceiling set forth in a secret schedule would not be conducive to good practice. Rather, they propose that the Board at least experiment with the simple plan of paying architects their customary fees.

Furthermore, the educators went on record in favor of having the architect (and engineer) utilized in site selection, establishment of preliminary cost estimates, and supervision of construction. It is likely that this supervision on the site, to make sure that plans are followed and all materials and workmanship are up to standard, will be more satisfactory and efficient than the overlapping checks now provided by the inspectors working for several of the city agencies.

**Wishing**

Quote from Enoch Needles, president of the Engineers Joint Council, in the recently released EJC annual report — "I wish that NSPE could find it possible to join the Founder Societies and their associated national engineering societies in becoming a member of both EJC and ECPD. I believe the general engineering population would consider it to be wholly appropriate and dignified if all our national engineering societies could enroll themselves in one Council, designed as a common meeting place for discussion and appropriate inter-society action on the mutual problems of our profession."

The American Society of Civil Engineers said the same thing last



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October: "Recognizing the importance of NSPE as a vital and dynamic influence for the advancement of the engineering profession, and envisaging the great contribution to the profession that could result from the participation of that Society in both EJC and ECPD, the Board of Direction of ASCE would view with high favor the simultaneous affiliation of NSPE with both EJC and ECPD, and hereby expresses the hope that it may have an early opportunity to approve and to welcome such affiliations on an equivalent status with that of each of the five Founder Societies."

## Not to Join

The U. S. Chamber of Commerce, which recently got the Consulting Engineers Council as a new member, also issued an invitation to the American Society of Civil Engineers. The Civils decided not to join because of overlapping member interests, possible jeopardy to the ASCE tax status, and possible future conflicts between professionalism and commercialism.

## NSPE Objects

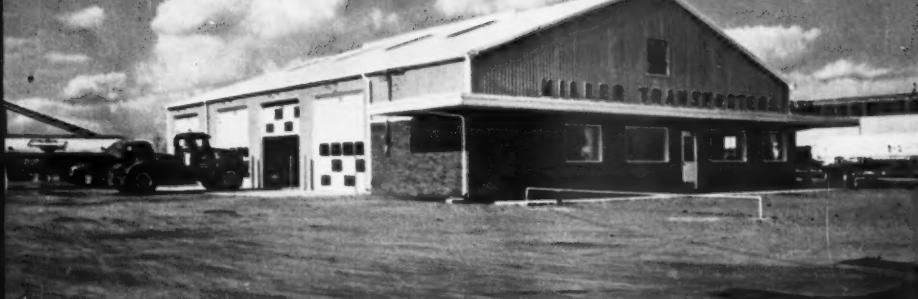
The National Society of Professional Engineers has protested an appointment by the Secretary of the Interior of a medical doctor to replace an engineer as director of the Office of Saline Water.

The new appointee is Dr. A. L. Miller, a physician and former member of Congress from Nebraska, who was defeated in the last election. He succeeds David S. Jenkins, a civil engineer, who now has been named assistant director.

NSPE maintains that positions of high responsibility in engineering fields should be filled by engineers.

## In Wisconsin

The architects have been giving the engineers a bad time. A bill introduced in the Wisconsin Legislature would impose a special examination on registered professional engineers before they are al-



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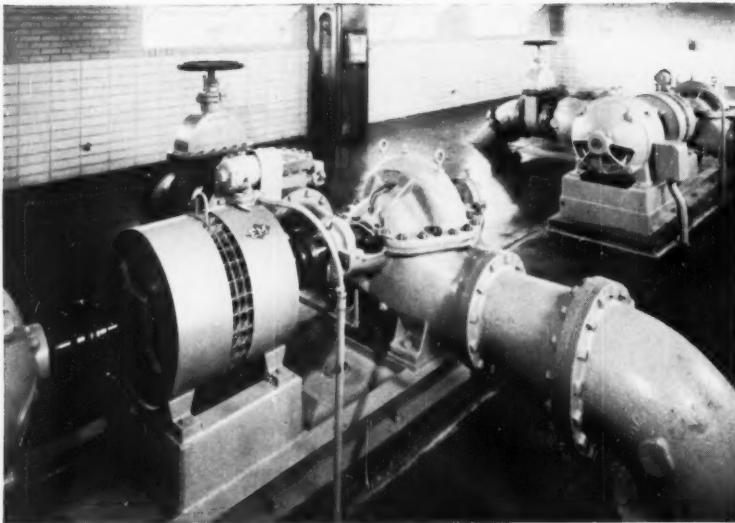
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Parkhill, Smith & Cooper favored the 2-pump plan for these reasons:

**Minimum Capital Investment.** The three-pump plan would tie up a considerable amount of capital in an extra pump, motor and control without adding appreciably to the

volume of sewage pumped.

**100% Peak Standby Capacity.** Two pumps with E-M Ampli-Speeds could handle present demand efficiently, yet still have enough reserve capacity for 100% peak standby.

**Low Cost Expansion.** Later another pump could be added to *double* the station capacity and still allow 100% peak standby. And as a further saving, the building would *not* have to be enlarged to accommodate this third pump.

**RESULT:** Acting on the advice of its consulting engineers, Odessa accepted the 2-pump plan and now enjoys efficient, low cost pumping.

As your clients' pumping needs grow, give them the economy and versatility of E-M Ampli-Speed Magnetic Drives. Call your nearby E-M Sales Engineer and write for Bulletin No. 243. It contains selection charts and tells how Ampli-Speed works.



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lowed to design buildings. Termed "dual registration" by consulting engineers affected, the bill was introduced at the request of the Wisconsin Chapter of the American Institute of Architects. But engineers are rallying. The American Society of Civil Engineers sent word that all possible support will be given to the Wisconsin Section in opposing the bill.

### A Matter of Record

From now on, anyone found guilty of violating the American Society of Civil Engineers Code of Ethics runs the risk of reading all about it, including names, in *Civil Engineering*. The board will decide publication policy on each case individually. They will limit stories to factual statements of action.

### Busy Nuclear Year

In 1960, American engineers may have two nuclear shows to update them on the latest developments.

The Nuclear Congress, coordinated by the Engineers Joint Council, is scheduled for April 3 to 8 in New York City's Coliseum.

The Atomic Industrial Forum and the American Nuclear Society, two participants in the Nuclear Congress until April, currently are polling members to see if they want a small nuclear show held in conjunction with the joint meeting of the two groups in San Francisco.

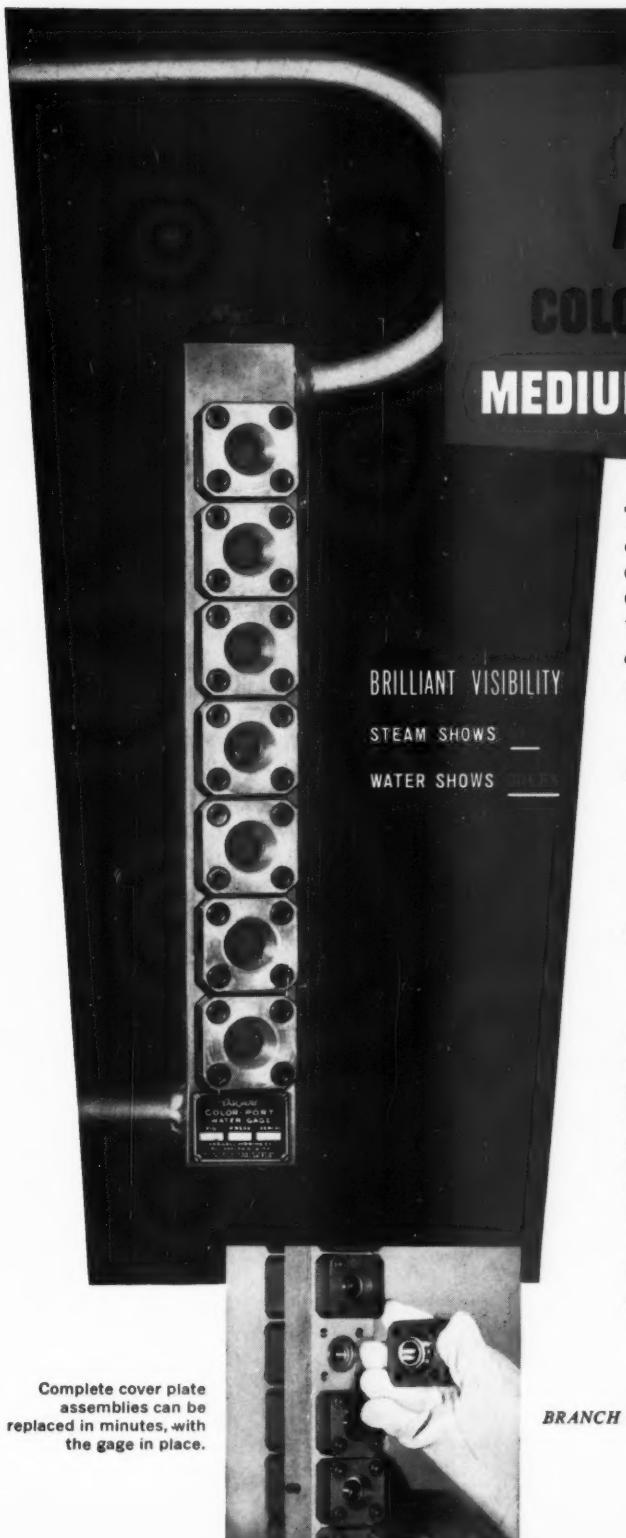
First large atom show sponsored by the Forum and the Nuclear Society will be in 1961, either in New York City or Pittsburgh.

### Exhaust Pollution

The U.S. Public Health Service is inquiring into air pollution from all causes, including exhaust gases. Both the automobile and oil industries are cooperating, with each industry spending about \$1 million a year for research on air pollution.

The USPHS spent \$4,012,000 on air pollution research for the 1959 fiscal year, and has asked Congress for \$4,212,000 for the new fiscal year, starting July 1. ▲

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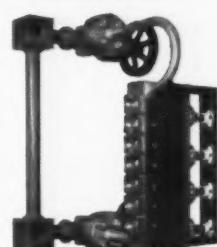
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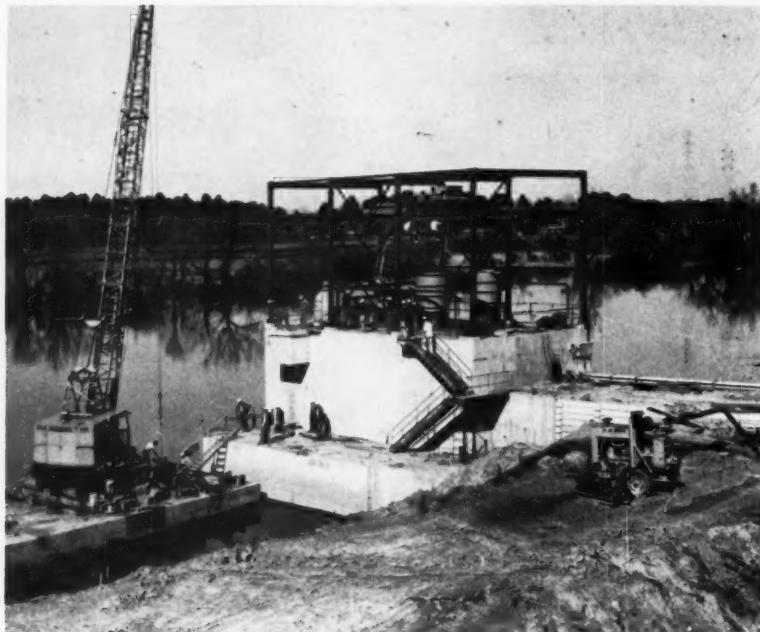
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# YARWAY



*An intake-discharge structure being constructed for a large steam electric power station.*

## Some Neglected Design Problems of... Circulating Water Systems



R. T. RICHARDS, Civil Engineer  
Ebasco Services Incorporated

*R. T. Richards received a B.E. degree in Civil Engineering from Yale University in 1943, and a Masters Degree from Columbia in 1947. He joined Ebasco Services in 1948. He has been active in the design of concrete structures, dams, and pumping stations serving electric power stations and has given particular attention to the hydraulic problems of circulating water systems. His research in this field has been discussed in ASCE and ASME technical papers. Richards is a registered professional engineer in New Jersey and an associate member of the American Society of Civil Engineers.*

THE CIRCULATING WATER SYSTEM is a vital element in the operation of a steam electric power plant, yet too often it is a weak link in terms of efficiency and engineering design. Perhaps the reason is that the engineering know-how for designing much of this large pumping facility is in the field of pipeline hydraulics, a specialized branch of civil engineering not otherwise required in power plant design.

Recognizing this fact, our civil engineering department has been conducting a research program for several years. The objective has been to look into both theoretical and practical field problems associated with circulating water system hydraulics and hydraulic structures. This program has pro-

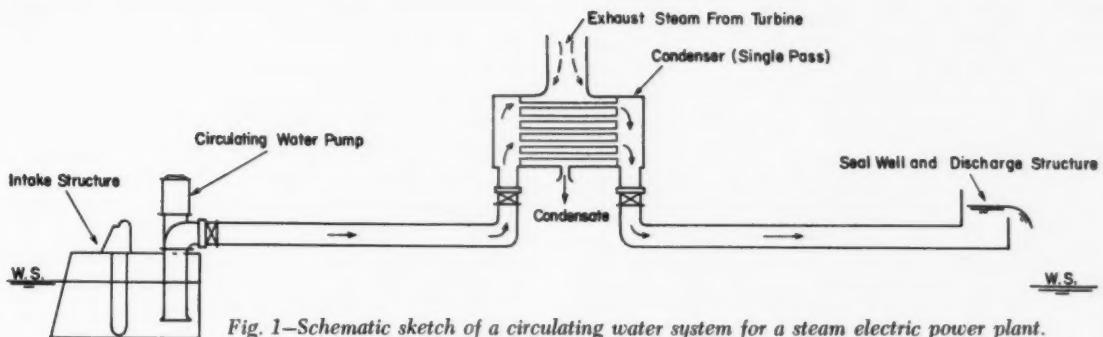


Fig. 1—Schematic sketch of a circulating water system for a steam electric power plant.

duced a noticeable reduction in cost and improvement in efficiency and reliability — considerations that should be of considerable interest to other consulting engineers.

#### System Characteristics

In today's large steam plants, the circulating water system is often a major engineering installation in its own right. The hydraulic structures, pumps, and conduits represent a facility that rivals in size and complexity a pumping station supplying the entire domestic water supply needs for our largest cities. Pumping capacities exceeding 350,000 gpm or about 500-million gpd are not uncommon.

Basically, its function is to circulate cooling water through the main condensers, as shown schematically in Fig. 1. A number of problems enter into the design, however, and those that are wholly or partly the responsibility of the hydraulic engineer include:

- ¶ Screen structure
- ¶ Trash racks and trash handling equipment
- ¶ Traveling water screens and their associated wash pumps and operating controls
- ¶ Selection of circulating water pump type to meet mechanical requirements and fit the site conditions
- ¶ Pump chamber, with particular reference to the shapes of the water passages or pump inlet piping
- ¶ Sizing and layout of the conduits to and from the condenser, including the hydraulic design of bends and similar details
- ¶ Calculation of the pumping head required for satisfactory operation
- ¶ Selection of the operating valves and establishment of the operating procedures
- ¶ Water hammer investigations
- ¶ Investigation of conduit air binding and selection of air evacuation equipment
- ¶ Setting of discharge elevation to obtain optimum siphon utilization
- ¶ Design of the seal well, discharge structure, internal diversion structures, tempering chambers,

sand traps, and miscellaneous other hydraulic facilities which may or may not be required at any given station.

Two major items have been purposely omitted from this list — site selection and the condenser. Their obvious prominence has subjected them to intensive study over many years, and they are not often among the neglected hydraulic problems. Many of the listed components also have been engineered carefully. But there are others — particularly those that are partly hydraulic and partly mechanical — where overlapping of design responsibilities has resulted in less than efficient engineering. These are the major pitfalls of circulating water system hydraulic design.

#### Screen and Pump Chamber Design

At the majority of plant sites the screen and pump chambers are combined in a single intake structure at or near the edge of the source of cooling water. On Ebasco projects in the past ten years, over 75 percent of the pumps have been vertical mixed flow type, mounted in the customary wet well structure. As shown in Fig. 2, the usual facil-

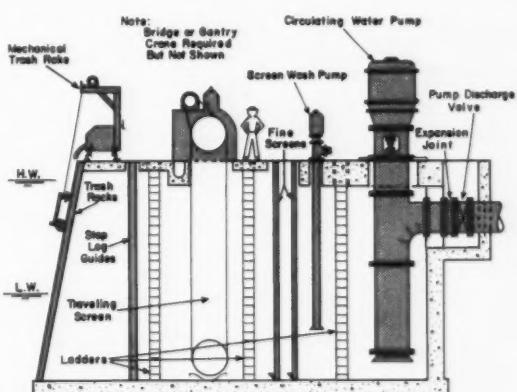


Fig. 2—Typical intake structure and equipment.

ties provided are: inclined trash rack with bars spaced at about 3 inches on center; on some projects, a mechanical rake and trash car; stop log guides; traveling screen; two sets of guides for fine screens; screen wash pump; and finally the circulating water pump.

It is apparent from Fig. 2 that even with a minimum of facilities, the intake structure will be of substantial size, especially where water level fluctuations are great. For example, one typical intake structure, recently constructed on the Ohio River to handle over 500,000 gpm with 12 vertical mixed flow pumps, is 91-ft high, 153-ft wide and 62-ft long from back to front. The pumps themselves measure 93 feet from bell to top of motor. A volute pump dry pit structure to handle the same flow would have been nearly twice as wide and several feet deeper and longer.

When possible the use of vertical screen wash pumps is avoided by using horizontal booster pumps taking suction from the circulating water pump discharge. Several manufacturers of circulating pumps object to the presence of vertical screen wash pumps in front of the circulators, or they require a considerable distance between the two pumps, which undesirably increases the length of the structure. The horizontal screen wash pump, on the other hand, can be placed at any convenient location on or near the intake structure.

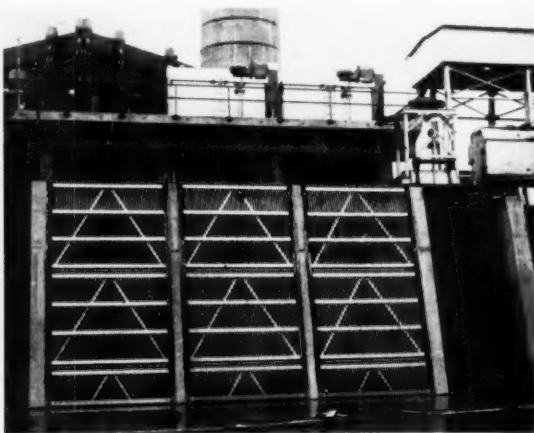
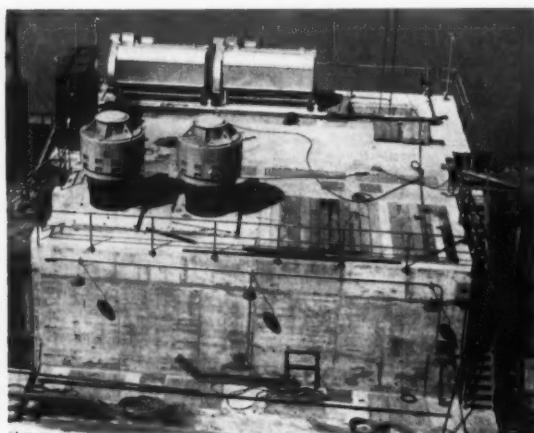
Two sets of fine screens are provided to permit alternate operation; one remains in the waterway while the other is being cleaned. These fine screens normally are used only when the traveling screens are removed for repair. In multiple bay intakes only one pair of screens would be furnished, not a pair for each bay. It is interesting to note, however, that in rare circumstances, particularly in

some southern areas, both the revolving and the fine screens are kept in place to handle unusual quantities of water plants and algae. A trash trench is provided for the fine screens as well as the one for the traveling screens. In many installations where fine screens are needed only for emergencies, deck space has been saved by omitting one set of screen guides and using the stop log guide for the front set of screens.

For traveling screens the maximum design water velocities through the net screen area normally should not exceed 2.5 fps at extreme low water. At higher velocities the rate of screen clogging rises very rapidly. The approximate net water passage area through the screen can be determined by subtracting 1'-2" from the gross width of the chamber (to account for frame interference) and taking 50 percent of the remaining waterway area. On most projects the depth and width of combined screen and pump chambers are not determined by screen dimensions but by the side and bottom clearance requirements for the vertical circulating pumps.

Pump clearance requirements within the suction chamber are specified by the circulating water pump manufacturer. Since vertical pumps are particularly sensitive to poor distribution of flow at their bell entrances, it is imperative that the physical dimensions of the chamber be such that the desired flow conditions will be achieved. Unfortunately, manufacturers of essentially similar pumps do not agree on what constitutes optimum design.

As a general rule of thumb, a clearance of  $\frac{1}{2}$  bell diameter from the bell to the side walls, back, and bottom of the chamber is satisfactory for preliminary studies. However, our experiences in detailing final designs indicates that keeping the back wall within a few inches of the pump bell and allow-



Two views of an intake structure, with the pumps shown at left and the inlet from the river side shown at right.

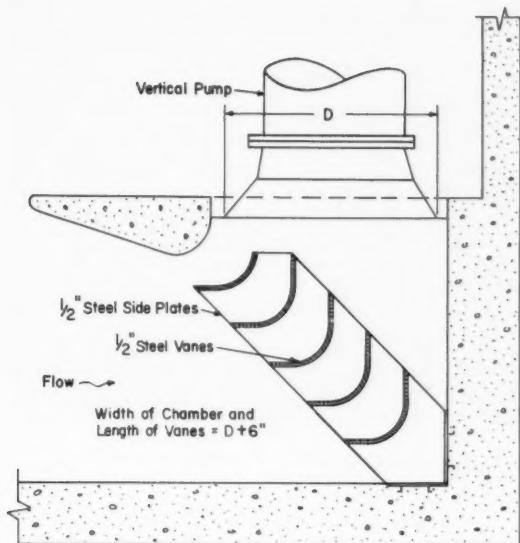


Fig. 3—Typical pump setting using a vaned elbow.

ing a bottom clearance of 1/3 to 1/2 of the pump bell diameter provides the best assurance of proper pump operation. Increasing these two clearances to the one bell diameter still recommended by some manufacturers sometimes has resulted in undesirable vortex action.

The use of individual pumps exceeding about 65,000 gpm in capacity sometimes results in chamber dimensioning problems. The chamber width needed to accommodate two pumps may be three or four feet wider than the maximum width of commercially available traveling screens (11'-2" including basket and frame). The chambers must be deepened to maintain proper screen velocities and widened in the section between the screens and the inlet bells. This widening interferes with uniform water approach to the pumps and thus presents a dilemma in dimensioning. Frequent solutions are the use of two small screens per pump bay, or a structure with three screens for two pumps or four screens for three pumps.

Occasionally the project limitations will introduce pump location problems that do not fit into the standard patterns. Then properly conducted model tests are recommended to assure appropriate dimensioning. For a modest cost, in the light of the importance of proper pump performance, such model tests can be done by a number of pump manufacturers and university or commercial hydraulic laboratories.

One variation of the normal vertical pump setting has given particularly good flow distribution and pump performance since its first circulating

water pump application in the United States about 1951. This is the vaned elbow or set of five to eight horizontal guide vanes placed under the pump bell as shown in Fig. 3. This elbow not only promotes satisfactory hydraulic conditions, but permits use of a narrow chamber, only a few inches wider than the pump bell. The chamber must be deeper, however, to accommodate the elbow, and this sometimes cancels out construction cost savings made possible by the reduced structure width. Ebasco has used this setting with success in 20 stations.

Horizontal centrifugal pumps also afford a design alternative. The principal disadvantage to their application where the intake water varies widely is the very large dry pit that they require. Although they are capable of considerable suction lift, it is good practice to place them entirely below low water to avoid the necessity for foot valves and priming. In cooling tower installations they will be competitive with vertical pumps and often are to be preferred.

One advantage of horizontal centrifugal pumps is that they are not nearly as sensitive to inlet flow irregularities as vertical pumps. In general, two inlet piping restrictions should be observed; avoid sharp piping bends or multiple bends in the inlet piping, and avoid high points which might collect air. Reducers should be eccentric, giving a level top to the piping. If pockets cannot be avoided (for example, at some tunnel-pump connections) adequate air vents must be provided. Free air collects very rapidly, especially in cooling tower installations, and unvented air will periodically pass through the pump, resulting in rough operation.

#### Water Hammer and Operating Controls

Comprehensive knowledge of the surge characteristics of a circulating water system is essential to the engineer responsible for the design of the operating controls. Too often fear of the unknown has resulted in unnecessarily complex control systems, when actually relatively simple controls can minimize water hammer. Proper protection for the pump, conduits, and condenser can be assured if the pump and valve control system selection is based on an analysis of typical surge problems.

Pump trip-out due to loss of power is the condition most likely to cause excess surges. Following trip-out the water continues to move toward the discharge, but very little flow, if any, enters through the pumps. The result is a rapid drop of pressure at the pumps and also at the condenser discharge. With long conduits and quickly decelerating pumps, the pressure may drop to absolute zero; then as the water column continues its forward motion, it separates, leaving one or more voids in the system. The column eventually reverses its

self and flows back to fill these voids. At the instant of void closure a very sharp surge develops, but the peak passes so quickly that pressure relief valves are useless.

Several years ago we conducted a series of extensive surge tests on several make-up water pumping plants and a major circulating water system.<sup>1</sup> These tests very clearly illustrated the severity of power failure surges on these particular installations. Fig. 4 shows a typical surge test curve. There is little that can be done from a valve control point of view to eliminate these surges. Vacuum breakers, air chambers, or any of a number of other surge protection devices may be necessary. Fortunately, only a very few installations are so long that specific surge protection is necessary.

Fast closure of the pump discharge valve also would have the same effect as a pump trip-out, so it is essential that the normal valve closure timing be long enough to permit safe deceleration of the water column. This is not a major problem because a reasonable closure time can be established without too much trouble.

Pump start-up produces the next most severe surge condition. Rapid acceleration of the pumps and quick opening of the pump discharge valve will produce a noticeable surge throughout a filled system. Proper valve timing will keep this surge within reasonable limits.

Occasionally it is possible and economical to install a circulating water system without any valves at all. This arrangement does not provide hydraulic control either during system filling or normal start-ups, but careful observations on several systems with pump to condenser conduits not exceeding about 300 feet have indicated no undesirable surge conditions either in the conduits or at the condenser.

Conservative practice favors slow filling of long empty systems with the valve partially open. However, we see no necessity for complex controls to

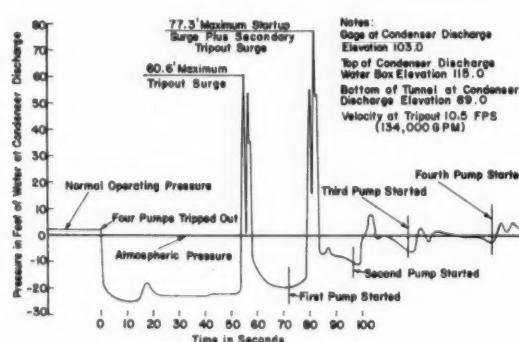


Fig. 4—Field test record of four pump trip-out surge.



Fig. 5—Overdesign caused this pump impeller failure.

prevent inadvertent opening of the fill valve; this can be clearly covered in instructions to operators.

The field tests previously mentioned also brought out another very severe condition — a combined trip-out and start-up surge — that requires careful consideration. Under no circumstances should a pump be restarted until the trip-out surge has passed, usually 60 to 80 seconds after trip-out. Combined start-up and trip-out surges may well be excessive. A time delay feature can be included in the pump control circuit to give positive protection against this occurrence.

For most of its stations Ebasco has adopted a simple control system that eliminates undesirable hydraulic shocks and provides adequate automatic control. Motor operated butterfly valves are used exclusively at the pump discharge if any valves at all are required. Operating characteristics are: *Pump start-up with system empty* — Start pump and valve simultaneously. Stop valve by manual or automatic control at approximately the 15 percent open position. Fill the system before opening the valve completely.

*Pump start-up with system full* — Start pump and valve simultaneously. Move valve to full open position in 20 seconds for systems less than 3000 feet in total length. For longer systems surge analysis may indicate the need for a longer timing.

*Normal pump shutdown* — Trip pump and start valve closure cycle simultaneously. Close valve completely in 20 seconds for systems less than 3000 feet in total length. If for some reason the operator wishes to close the valve against an operating pump, the valve closure time must be increased to at least 60 seconds.

*Power failure to pumps* — Close valves in 20 seconds if power is available for valve motors. If

there is a complete loss of power to pumps and valves no harm will result when valves remain open. Pump discharge valves should be closed, however, before the pumps are started up again.

As noted under the instructions for a normal pump shutdown, closing a valve against an operating pump requires a substantially longer closing time than for closure after the pump is tripped. A particularly smooth deceleration of the water column can be achieved by such a closure, but usually this is not necessary unless the conduit system is several thousand feet long. The pump must have a horsepower characteristic that does not require an extra large motor at shutoff pressure.

The reason for the longer closure requirement is readily apparent. The head behind the valve rises as it closes, and the valve does not cut off substantial flow until it is well closed. The rate of flow stoppage, or net valve closure time, is thus very fast compared with the nominal closure time. For example, on one occasion we witnessed the inadvertent closing of a 20-second valve against the operating pump of a long make-up water pipeline. The surge that followed the initial water column separation was violent and produced recorded surges almost 100 percent above the nominal 100-psi strength of the conduit. Fortunately, no damage was done, but the lesson was clear. The usual circulating water system for a power plant, designed for much less head, certainly would have suffered severe damage.

This control system can be applied to centrifugal and mixed flow pumps but not to axial flow pumps. The axial flow pump with its high shutoff power requirement normally will be started up only after the discharge valve has partially opened. Also the axial flow pump generally cannot be used to fill the system because too high a head is developed before siphon over the condenser is developed. Filling by auxiliary means is required. Since the head requirement for most circulating water sys-

tems is above the maximum range of the axial flow pump, they seldom are used.

#### Hydraulic Gradient & Pump Operating Points

It is recognized by most manufacturers and consultants that circulating water pumps usually are overdesigned. This is not only wasteful but may result in premature wear because the pump must operate continuously at heads below the nominal design point. Overdesign results from four factors: conservative selection of design low water level at the intake; overestimating hydraulic losses through the system; the very conservative condenser head loss figures specified by the condenser manufacturer; and lastly the pump manufacturer's margin. Taken together, these factors result in the selection of pumps with 10 to 40 percent excess capacity on most projects.

With oversize pumps, excessive condenser tube velocities are possible and premature wear of the pump is probable. Fig. 5 shows the impeller of an overdesigned circulating water pump. Severe pitting due to cavitation put this impeller out of service in less than a year. The consulting engineer can do his part in correcting this situation by selecting a reasonable design low water elevation and carefully calculating the system head losses. These losses must be based on friction factors for large conduits, not the high factors generally employed for small mechanical piping.

To aid in both design and operation, two graphs should be prepared for every circulating water system: a graph of the hydraulic gradients for primary operating conditions, and an operating point graph indicating at a glance the head range over which the circulating pumps will be expected to operate.

As shown in Fig. 6, the hydraulic gradient or pressure line is the locus of points of pressure throughout the system plotted on an exaggerated scale profile of the conduit. The pressure or vacuum

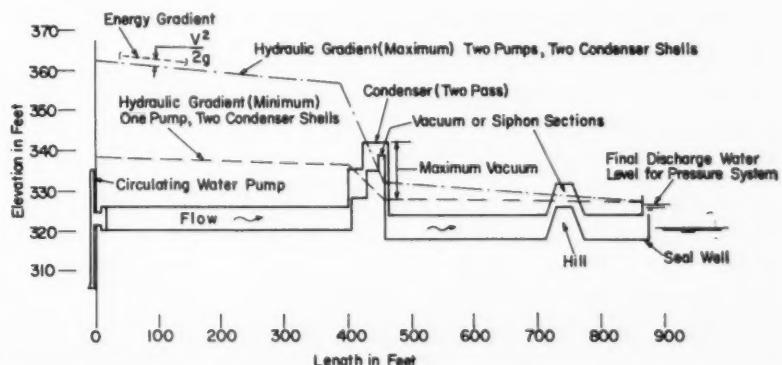


Fig. 6—A graph of the hydraulic gradients shows the normal operating pressure at any point in a circulating water system.

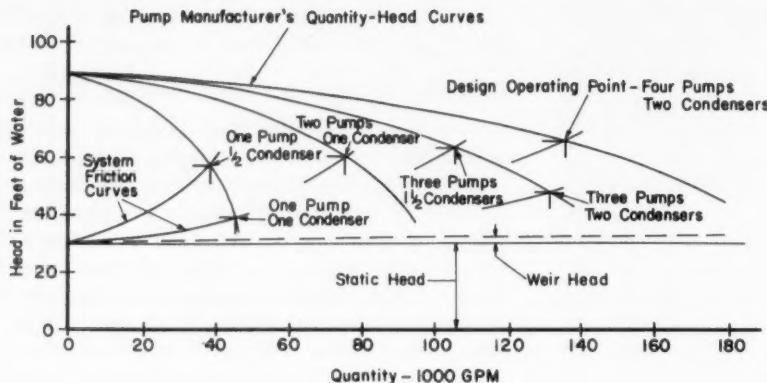


Fig. 7—An operating point graph shows the relation between the quantity-head characteristics of the pumps and the friction head-quantity curves of the system.

at any point along the conduit is the vertical distance up or down from the point in question to the gradient. This graph shows the normal operating pressures throughout the system and is particularly useful for determining the suction or discharge conditions for auxiliary service pumps taking water from the circulating water conduits. Note that the total energy in the water at any point exceeds the hydraulic gradient by one velocity head,  $V^2 \div 2g$ .

The operating point graph, Fig. 7, indicates the extreme ranges of head against which the pump will have to deliver water. It may well be that some point, especially that representing a single pump operating through two condenser shells (1 condenser) will be beyond the safe operating range of the pump. This information must be passed on to operators in the detailed operating instructions that should be prepared for every circulating water system. The operating point is the point of intersection between the pump quantity-head characteristics curve (for one or more pumps) and the friction head-quantity curve for the system. Note that the friction head-quantity curve for the system ( $H=K_1Q^2$ ) should be separate from, but constructed on, the seal well weir head curve ( $H=K_2H^{3/2}$ ) and the static head curve  $H=K_3$  for stations where weir head and static head must be taken into account. Fig. 7 identifies each of these elements and shows proper graph arrangement.

#### Design of the Seal Well

The seal well is the final discharge point of the pressure circulating water system. Its function is to prevent air from entering the conduit and blowing back into the condenser. The condenser can be likened to a hill over which the water must be pumped. Except in cooling tower plants, the condenser section of the system operates as a siphon, and this greatly reduces the total pumping head. The siphon is maintained by sealing the conduit at a seal well whose outlet sets the final elevation to

which the water must be lifted. For plants high on river or lake shores, the lower the seal well can be set the lower will be the static head.

Most of the modern sea level plants we have designed are operating at siphons of minus 28 feet of water or more, and one has operated successfully at minus 30 feet — very close to vapor pressure during certain seasons of the year. The important point to clarify here is that these are actual maximum vacuums within the system and do not represent fixed vertical distances from the top of the condenser to the seal well weir, an error of viewpoint sometimes held. The seal well weir head and friction in the condenser to seal well conduit thus can be added to the maximum allowable siphon to get the actual vertical distance from the seal well weir to the top of the condenser or other critical high point. This is illustrated in Fig. 6. The weir should be made adjustable by the installation of stop logs to permit operators to experiment with maximum possible siphons.

A top inlet, bottom outlet, double pass condenser has considerable hydraulic advantage over the top outlet condenser in most common use several years ago. The point of maximum vacuum usually is the top of the second pass water box, which may be 6 or 7 feet below that for a top outlet condenser. It never should be assumed, however, that the division between condenser passes is on the horizontal center line of the condenser. The actual elevation of the top of the discharge water box must be checked with the manufacturer, for an error in assumption here may result in a seal well at too low an elevation.

In many power plants, along rivers lined with flood dikes, there may be two additional siphons where the intake and discharge conduits pass over the dikes. River control authorities often do not permit a conduit to go through the dike. The elevation of the seal well will be based on either the elevation of the discharge pipe over the dike or

at the condenser, whichever is higher. The principles of setting the weir elevation are the same for both cases.

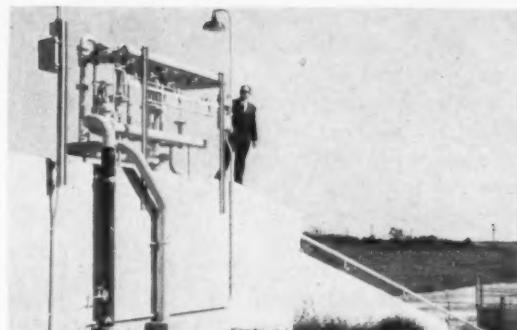
The advantages of a high siphon apply, of course, only to plants set so high above the circulating water source that some static head will exist. There is no advantage in raising a condenser at a water level site just to get a high siphon. Siphons are useful only in the head that they save. They are otherwise objectionable in that they promote release of air from the water and frequently open the way for development of surge problems.

### Air Binding

Air binding may seriously reduce the efficiency and flow in many circulating water systems. It may be defined as the trapping of air within the water passages in such a manner that they do not flow full. The collection of air in the upper part of the condenser is a common example. The most serious effect of air in the condenser is the reduction of the number of tubes that are available for heat transfer; it has relatively little effect on the pumping head or flow.

Many condensers will be self priming, others will require continuous air removal. The ability of the condenser to purge itself of air appears to depend on the configuration of the outlet water box and outlet piping. On our projects we do not recommend permanent air evacuation equipment unless the need becomes evident after the system has been put in operation.

A far more serious air binding condition may exist in the conduit system itself, especially in the run from the condenser to the seal well where many conduits are designed to flow under vacuum for the entire distance to avoid excess excavation during construction. If the conduit slopes downward in the direction of the flow, for example on the downstream side of a dike crossing or passing one conduit under another, it will not flow full unless continuously evacuated by supplementary air removal equipment.<sup>2</sup> It will flow instead as an open channel, and the hydraulic gradient will roughly parallel the slope of the pipe. Fig. 8 indicates the



A typical installation using water jet exhausters.

resulting excess head losses that will occur for this condition. If the change in grade along the slope is large the resulting head loss will seriously reduce the flow in the circulating water system. For example, we have observed several installations where the excess head loss becomes 15 feet or more when the air evacuation pumps are shut off.

To avoid this problem taps should be placed not only at the top of the slope but along the slope where the air pocket lies, as shown in Fig. 8. Air may be removed by rotary vacuum pump or, for a vacuum less than about minus 18 feet, with water jet exhausters. The jet installation is simpler as it does not require the numerous controls, air tanks, float valves, and seal water lines that complicate a rotary vacuum pump installation. Water pressure for the jet can be obtained from the plant elevated water tank or from a booster pump taking suction from the circulating water tunnel.

Experience has indicated that the amount of air to be removed is about 10 percent of the air theoretically released when the water pressure is reduced in the siphon and the water temperature increased in the condenser. Van Hengel<sup>3</sup> has plotted curves that simplify the determination of the theoretical air release.

These hydraulic pitfalls, though not all inclusive, are representative of the problems to be expected in nearly every circulating water system. Since each installation will have its own peculiarities, engineers with sound hydraulic know-how are essential to obtaining reliable and economical design and performance. ▲

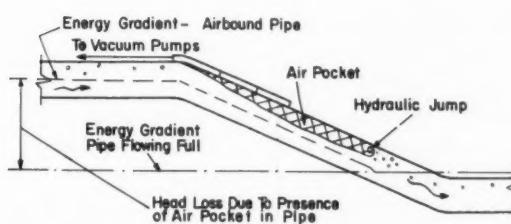
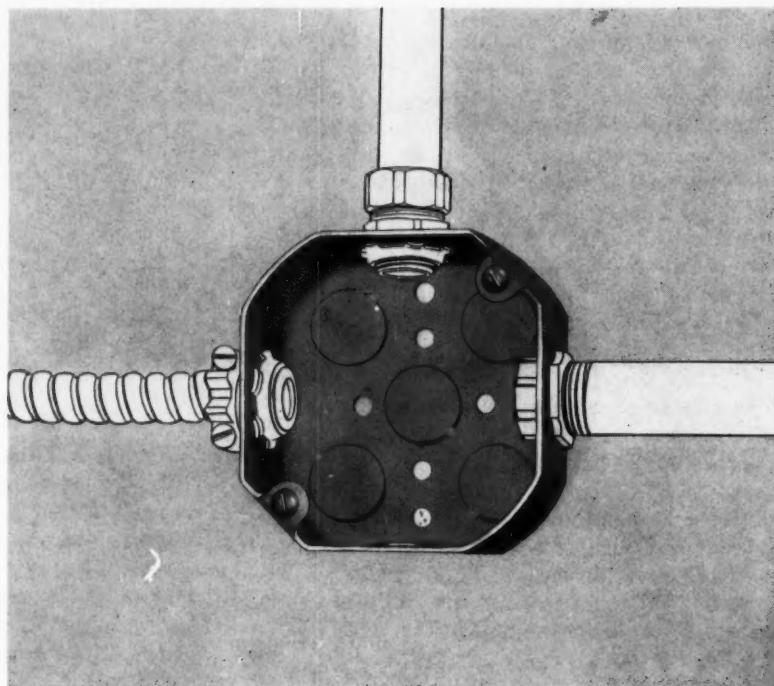


Fig. 8—Affect of air pocket on hydraulic gradient.

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*Flexible armored cable, thin wall tubing, and rigid conduit are the three principal types of metal-sheathed conductors.*

## Consultants Can Specify Fewer Fires

ROBIN BEACH

Robin Beach Engineers Associated

**DURING THE PAST DECADE**, nearly 18 percent of the property losses from fires were attributed to the "misuse of electricity." It is clear, therefore, that the consulting engineer must consider the safeguarding of his client's interests from fire hazards as a major design responsibility, and branch-circuit wiring ranks high among the areas of concern.

Currently, design practices involve three principal arrangements of metal-sheathed conductors:

¶ In practically all large, modern, fireproof commercial and industrial buildings, the branch-circuit wiring is installed in rigid metal conduit — a requirement stipulated not only by the NEC but by many of the more discriminating municipal codes. ¶ Electrical metallic tubing (EMT), commonly referred to in the trade as thin wall tubing, finds wide application on electric wiring installations where

dry conditions favor its use for economic reasons.

¶ For many service requirements, Type ACT flexible armored cable is convenient and inexpensive. A knowledge of the safety of these methods compared with the old Type AC flexible armored cable used so extensively for several decades — particularly their behavior under fault conditions — is essential in producing satisfactory designs.

### Type ACT Cable with Bonding Strip

In recent years, recognition of the various types of fire hazards long identified with old Type AC cable has stimulated manufacturers to attempt improvements in the construction and composition of flexible armored cable. Thermoplastic Type T insulation has been gradually supplanting the long-used Type R or Type RU code, or latex rubber, insulation in branch-circuit wiring. Also, within

the flexible interlocking armor, a bare bonding strip now is included with the thermoplastic insulated conductors, the objective being to increase the conduction and consequently reduce the heating of the armor when certain types of ground-fault conditions occur. Armored cable with these added features currently is designated as Type ACT cable with bonding strip.

Underwriters Laboratories established a standard in 1956, making the use of thermoplastic insulation and the bonding strip mandatory in all "U-L Approved" Type ACT cable. The minimum allowable size of the bonding strip for No. 14 and No. 12 Type ACT cable is specified as No. 16 for aluminum or No. 18 for tinned copper. Dimensions of the galvanized steel strip in the metal interlocking armor, as specified by the National Board of Fire Underwriters, are the same for No. 14 and No. 12, 2-wire or 3-wire cable —  $\frac{1}{8}$ -in. wide and 0.025-in. thick. For effective wiring with Type ACT cable, the bonding strip must be electrically paralleled with the armor by securely connecting the bonding strip at each outlet box onto the end of the armor and tightly fastening them into the outlet box with screw-clamp connectors.

To evaluate the improvement of Type ACT cable with bonding strip compared with conventional Type AC cable, heating tests were conducted on each of the two common branch-circuit sizes by passing short-circuit current through the armor under identical conditions. The temperature charac-

teristics of the cable operating over a two-hour period at a current of 33 amperes during the overloading tests of No. 14 and No. 12 Type ACT cable, both with and without bonding strip, are shown in Fig. 1. Solid lines are for No. 14 cable, and dashed lines represent No. 12 cable. The lower curve for each size covers cable with the bonding strip connected, and the upper curve with bonding strip disconnected.

An inspection of these curves reveals that the average reduction in temperature of Type ACT cable when using the bonding strip is about 7.7 percent for both sizes. While this reduction of the operating temperature under ground-fault conditions is a slight improvement, it seems much too small to provide any significant practical benefit. It even raises doubts as to the economic philosophy that prompted the mandatory status for Type ACT cable with bonding strip to replace all future use of Type AC cable.

Even more significant is the fact that well within one-half hour from the cold start of the temperature tests, the curves for the No. 14 and No. 12 Type ACT cable with bonding strip are seen to attain, and thereafter considerably exceed, the ignition-threshold temperature for dried-out wood. Hence the danger of fire originating from contact of dried-out wood with overheated cable remains a threatening hazard with both designs.

Another problem is that vast amounts of the old Type AC cable are still in service. While some users may decide that the best economics, safety-wise, dictate replacement of the old Type AC cable with the new Type ACT cable with bonding strip, this choice is voluntary. The new NEC rulings relative to the mandatory use of new and improved products are not retroactive. Therefore, during the several years' interim while the Type AC cable in useful existence is passing gradually into retirement and discard, the present users can learn more about the potential failures and fire hazards of the older cable under abnormal and deteriorating conditions, and more intelligent safety steps can be taken to safeguard life and property.

Also it is of special interest to note that No. 14 wire has been withdrawn as a conductor for branch-circuits. The minimum size of wire now allowed for electric wiring is No. 12 with No. 14 wire now assigned to use in signal wiring. Here again alert care and maintenance of No. 14 wire will be required until it finally is retired from branch-circuit wiring service.

#### Safety Auxiliaries

It should be noted that most difficulties with flexible cable arise from poor maintenance or usage under conditions beyond the design limitations. At

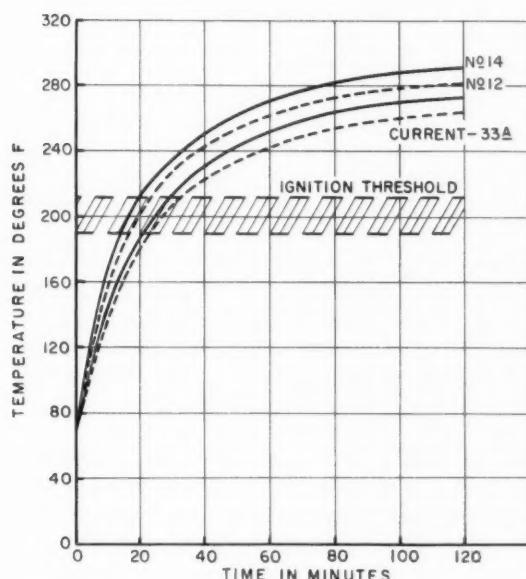


Fig. 1—Temperature-time curves for No. 14 and No. 12 Type ACT cable operating for two-hours at current of 33 amperes. The solid lines are without bonding strips.

least some part of this trouble usually can be traced directly to the safety auxiliaries.

Basically, the screw clamps required at grounded outlet or distribution boxes are supposed to provide a tight connection with the combined ends of the armor and bonding strip. Where the screw clamps become loosened, as they often do, and a ground fault occurs, the current may become resistance controlled to a value somewhat below the melting current of the circuit fuse. In such instances, if the fusing is overrated for No. 14 or No. 12 branch-circuit cable, dangerous overheating can develop, regardless of the use of the added bonding strip. This could be avoided through the development of a superior armored cable connector with positive locking screw clamps that would insure good contact.

#### New Holders Prevent Overfusing

Acknowledgement is due to those manufacturers who so skillfully resolved the overfusing hazard on branch circuits by initiating Type S fuseholders, with their ingenious nonremovable adapters and special plug fuses. However, until the general use of Type S plug fuses and their auxiliaries becomes mandatory for branch-circuit protection, serious abuses from overfusing and its resulting fire hazards will doubtless continue as a prime cause of dangerous overheating of armored cable — be it the old

Type AC cable or the superseding newly approved Type ACT cable with bonding strip.

#### Branch Circuits in Rigid Conduit

From safety considerations, rigid metal conduit, by virtue of its relatively high and maintained conductivity, possesses an excellent service record among the metal-enclosed types of branch circuit wiring in use today. Conduit actually is heavy-wall pipe, and for this reason, it can pass moderate fault currents harmlessly. The conduit size allowed by the NEC for 2-wire or 3-wire branch circuits with No. 14 or No. 12 conductors is  $\frac{3}{4}$ -in. electrical trade size, with internal diameter of 0.622 inch. With this specification, even the maximum fault currents that could occur on a circuit with overrated 30-ampere fuses, operating at maximum continuous 10 percent overcurrent, or 33 amperes, would not cause serious heating of the conduit.

Since rigid conduit is firmly secured at the outlet boxes with clamp connectors, locknuts, and bushings, there is minimum probability of controlled-resistance faults occurring at these points. The conductivity of the metallic ground circuit through the wall of the conduit, being generally much higher than for armored cable, causes most ground faults to pass sufficiently high current immediately to blow the circuit fuse and safely to clear the fault.

The exception, of course, involves those instances wherein high values of current may flow through the metal of the conduit or through ground wires within the conduit from ground faults which occur on the service or distribution lines. High temperature of the rigid conduit then can result from the electromagnetic induction of hysteresis and eddy-current heating.

Laboratory tests with 60-cps alternating current passing through a No. 6 wire within a  $\frac{3}{4}$ -in. rigid conduit produced the temperature-time curves shown in Fig. 2. Note that the figure contains a horizontal shaded band between 150 F and 165 F labeled "Threshold of Contact Pain." In this area, momentary touching of the conduit gives a sensation of burning. However, only the test with 125 amperes of 60-cps alternating current gave temperatures over the ignition threshold of dried-out wood.

#### Branch Circuits in Thin Wall Tubing

Thin wall tubing (EMT) of  $\frac{3}{4}$ -in. size has a wall thickness only 40 percent that of  $\frac{3}{4}$ -in. rigid conduit, both of electrical trade size. Therefore its conductivity, being proportional to the cross section of the metal, is approximately 36 percent that of rigid conduit for the same trade size. If an energized No. 14 wire within the EMT tubing or the conduit is connected to the metallic sheathing at the remote end from the power supply so that

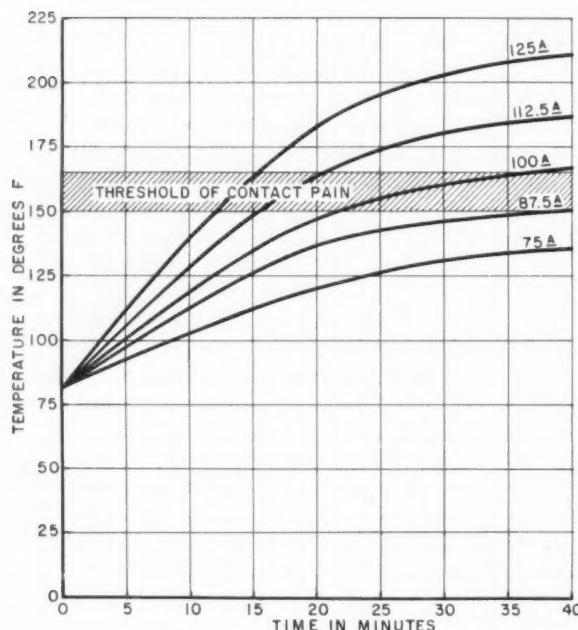


Fig. 2—Temperature-time curves produced in laboratory tests by 60-cps alternating current passing through No. 6 wire within a  $\frac{3}{4}$ -in. rigid conduit.

current passing into the wire returns through the metallic sheathing, the temperature rise of the metal is variously dependent on several sources of heating and, of course, also on ambient conditions. The sources of electrical heating are:

¶ Absorption of heat radiated to the surrounding metal sheath from the  $I^2R$  heating caused by the current in the No. 14 wire

¶ Hysteresis and eddy-current heating in the metal wall of the sheathing from electromagnetic induction effect of 60-cps current in the No. 14 wire.

¶  $I^2R$  heating in the metallic sheathing caused by the alternating current disposed largely in the outermost cross section of the metallic wall of the tubing or conduit

¶ Hysteresis and eddy-current heating contributed directly to the metallic sheathing by electromagnetic induction from the return current within the metal of the tubing or conduit

Identical tests using the same current, operating time, and heat shrouding will produce a higher ultimate temperature rise in the thick metal wall of the conduit than in the thin wall tubing because of the greater iron-loss heating. The temperature characteristics of  $\frac{1}{2}$ -in. conduit and  $\frac{3}{4}$ -in. EMT, each operating with 33 amperes in a No. 14 conductor within the metallic sheathing for a two-hour test period, with the fault-current return through the metallic tubing or conduit, are shown by the curves in Fig. 3. Note that both curves are safely below the ignition threshold for dried-out wood.

In Fig. 3, the coordinates and test conditions are identical with those in Fig. 1, covering Type ACT cable with and without bonding strip. This permits rapid checking of the alternate methods of branch-circuit wiring. The test results are conclusive in revealing that, under the common although dangerous practice of overfusing branch circuits, rigid conduit and thin wall tubing are unexcelled wiring methods within the metallic-sheathed cable classification.

### Conclusions

While emphasis has been directed against the potentially dangerous overheating of metallic cable sheathing, it should be noted that most fire losses come largely from the following ill-advised acts:

¶ Improper workmanship in the installation of electric circuits

¶ Negligent maintenance of electrical wiring, both at the consumers' premises and on the service lines of the power company

¶ Lack of adequate understanding by those who install water, steam, oil, and gas lines regarding the dangers of placing grounded pipes across and in contact with electric armored cable, tubing, and conduit without the use of intervening insulation

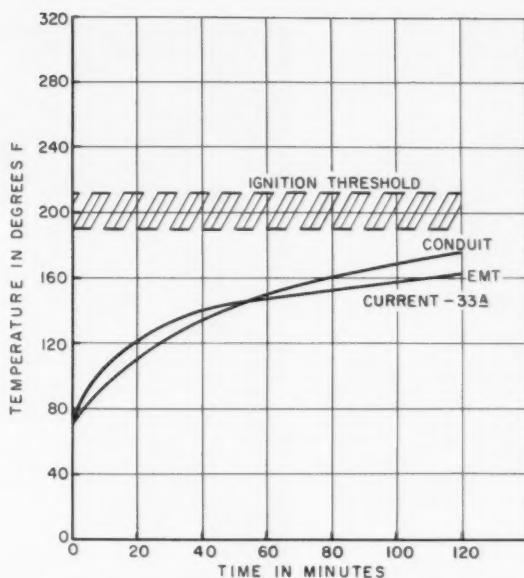


Fig. 3—Temperature-time curves for  $\frac{1}{2}$ -in. conduit and EMT, operating at 33 amperes in a No. 14 wire with fault current return through the metallic sheathing.

¶ Misinformed and willful overfusing of circuits  
¶ Failure, through inadequate or careless inspection of electric installations, to detect and correct hazardous situations before they lead to trouble

Undoubtedly the one most common contributing cause of electrical faults which overshadows all others is the overfusing of branch-circuit wiring. This situation commonly exists in homes, offices, and factories because the overfusing practice is participated in by the general public—housewives, teenagers, office and factory workers, do-it-yourself electricians, and other uninformed people who become irritated by the repetitious blowing of fuses. Yet frequently the condition results from their own overloading of circuits by adding air conditioning and other high-wattage equipment to inadequate circuits. Until the practice of overfusing electric circuits is stopped, fires originating from abuses of electrical services are certain to continue or even increase.

Perhaps one approach would be mandatory comprehensive inspections of all electrical wiring, nationwide, before fire insurance contracts are renewed. Violations in the electric wiring then would be caught in time to save untold millions of dollars annually, and even more important, to prevent loss of lives.

Certainly, the consulting engineer can help, both through careful design practices and by cautioning his client regarding the necessity for proper maintenance procedures.

*New office facilities for Burns & McDonnell are located well away from downtown Kansas City, on a 7-acre site with street frontage.*



## Burns & McDonnell Builds a New Office

R. G. KINCAID  
Partner

THE SIXTIETH ANNIVERSARY of Burns & McDonnell Engineering Company was celebrated by breaking ground for a new office facility in late March 1958. Just one year later, the firm was operating from their new, Kansas City, Missouri location.

Problems with existing office space began as early as 1955, but action was taken only after an exhaustive study of all aspects of ownership and rental. It finally was decided that Burns & McDonnell should design and build its own office, incorporating features tailored to fit its own particular needs. Accordingly, a building corporation, Burmac, Inc. was formed, a site purchased, detail plans and specifications drawn, and construction begun.

Since 1947, the company offices had been located 10 miles from downtown Kansas City. During that time the personnel complement of the organization had grown from 70 to 200 employees and the office space from 9300 to 16,000 square feet.

Based on experience with both growth and location, the following criteria for the new site and building were established:

- ¶ Ample space at reasonable cost in a desirable neighborhood with room for future expansion
- ¶ Location removed from traffic congestion and requiring commuting time of less than 20 minutes for the majority of the employees
- ¶ Private parking space adjacent to the office
- ¶ An office plan for a completely self-sufficient plant, not only for all employees, but also for reproduction work required in the preparation of reports, plans, and specifications

### General Description of Facility

The new office is located on a 7-acre tract with a 550-ft street frontage. The building site is on a hillside, surrounded by about 30 native trees, and all landscaping has been designed to supplement the desirable natural setting.

The plan is T-shaped, with a south frontage of 250 feet. Initial construction provides a floor area of 30,750 square feet on three levels. This provides adequate space for the present staff of 200, but provision has been made for expansion to 50,000 square feet. This can be done by completing the stem of the T-section and adding a third level to the two wings of the front portion.

The front wings of the building are 100-ft long by 50-ft wide and entirely free of interior columns. Precast and prestressed concrete floor framing was used in these areas. An inside patio adjacent to the west and north wings takes advantage of the site topography. The patio opens onto the lower ground area west of the building to give full exposure to first floor offices which are located in what normally would be the basement.

#### Construction Features

The main building frame is constructed of monolithic reinforced concrete and is founded on solid rock. Precast and prestressed concrete beams were used for all floor and roof framing except for the central core of the structure. These beams span 50 feet and are spaced on 5-ft centers. They acted as T-beams after the 3-in. monolithic floor slab was placed. Both beams and floor slabs are constructed of haydite concrete.

The building exterior is of face brick with cut stone trim. Veneer facing stone has been used for special architectural treatment of the front elevation. Aluminum has been used in sun shades, windows, doors, and railings.

The basic treatment of the interior masonry walls is painted haydite concrete block. Movable



*Library occupies 730 square feet of space. Dewey decimal and expanded AIA filing systems are used.*

type partitions are used in the private offices on the second and third floors. The only embellishment to this Spartan wall treatment occurs in the entrance lobby and in the administrative office area, where some wood paneling has been added.

Resilient tile flooring has been used throughout with the exception of a small carpeted area in the administrative office section. Ceilings are of acoustical tile except in equipment and storage areas.

All lighting fixtures are 265-volt fluorescent units. In the drafting rooms lighting fixtures are arranged on the diagonal to give the best light distribution regardless of furniture arrangement. The general illumination in the drafting areas presently measures about 95 footcandles at night and 120 footcandles during the daytime. While these intensities are a vast improvement over those in the old office, it is planned to make tube replacements that will increase the illumination levels to about 135 footcandles at night and 170 during the daytime. The exit light fixtures are a newly developed type using 6-watt fluorescent lamps rated for over 7500 hours. The incandescent type formerly used were good for only 1000 to 2000 hours.

The building is completely air conditioned the year-round. With minor exceptions, all windows are of the fixed sash type. Temperature for the entire building is controlled from a central panel located in the mechanical room. Approximately 1.35 cfm of air is supplied per square foot of area.

#### Arrangement of Office Space

The first floor is subdivided into the following areas: west wing, engineering and drafting area



*Reception room is one of few areas where wood paneling has been used over haydite concrete block.*



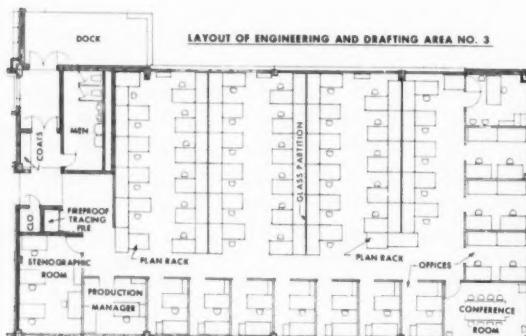
*Engineering and drafting areas have illumination levels up to 135 footcandles at night, 170 daytime.*

#1; east wing, reproduction area, including general files and storage; center section, mechanical equipment room and recreation room.

The second floor is allocated to: west wing, engineering and drafting area #2; east wing, engineering and drafting area #3; center section, reception and interview areas, library, and finance office.

Administrative offices are located on the third floor of the building.

The assignment of work stations in the engineering and the drafting areas was determined largely by current project requirements at the time of moving into the new office. A special effort was made to establish project groups, particularly for the major design projects. It is planned to regroup personnel from time to time as required to meet changing job requirements.



*Typical plan of engineering and drafting areas indicates how 100-ft by 50-ft area handles 59 people.*



*Six file clerks are on duty during regular working hours to provide scheduled pickup-delivery service.*

The dial telephone system in use in the new office has proven to be very satisfactory. The principal advantage is the speed with which interoffice calls can be completed. About 100 telephones are in use. All four conference rooms are provided with speaker type telephones.

#### **Engineering and Drafting Areas**

The office building includes three separate engineering and drafting areas each 100-ft long by 50-ft wide. The floor plan of Area #3 shows the typical arrangement of these areas. Private offices are provided for 16 principal or project engineers in eight single units and four double units. The drafting area will accommodate 39 engineers and draftsmen.

This drafting area is divided into  $3\frac{1}{2}$  sections. A typical section accommodates 12 engineers and draftsmen, four at desks and eight at drafting tables. The units are separated by glass partitions  $4\frac{1}{2}$ -ft high. This height creates a feeling of privacy when the draftsman is seated. When standing he is able to see the entire drafting area. Each man at a drafting station is provided with: a drafting table, chair, and drafting machine; a 30-in. x 70-in. reference table situated at his left; a three-drawer filing cabinet serving as a support for the reference table; a double book shelf located behind his chair and built into the adjacent drafting table. The drafting tables used in this particular wing were developed by Burns and McDonnell.

The other two engineering and drafting areas are arranged in sections similar to Area #3 except that standard drafting tables are used. These two



Complete printing facilities, for color and black-and-white, are included in 3500-square foot area.



Recreation room is provided for use during lunch periods and the officially sanctioned coffee breaks.

areas combined provide space for 83 persons in the drafting areas. If these areas are converted into the new arrangement used in Area #3 a total of 114 persons can be accommodated.

In each of the three drafting and engineering areas tracing files for active projects are enclosed by fire walls and fire doors.

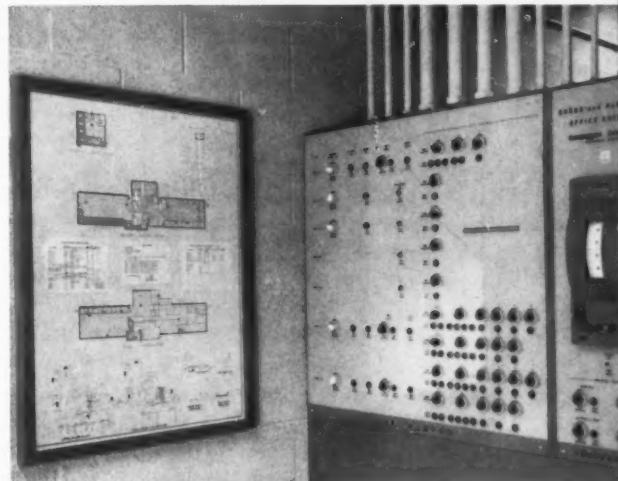
The wing known as Area #3 (including conference room, but excluding stenographic office, toilet, and front hall) has an area of 4375 square feet for 55 persons or about 80 square feet each. The open area for engineers and draftsmen provides an average area of 62 square feet per station, while the office area, including the conference room, averages 123 square feet per person. The typical section in the drafting area for 12 persons figures 57 square feet per station.

Every effort was made to increase the efficiency of engineering office personnel by providing them with work stations which incorporate important features in addition to ample floor space:

- ¶ Conveniently arranged to eliminate lost motion
- ¶ Work areas separated into small sections to reduce noise and confusion
- ¶ Proper air conditioning and lighting
- ¶ Noise level kept low with sound insulation
- ¶ All stations provided with suitable name plates
- ¶ Each employee is made to feel that he occupies an important and dignified position in a professional engineering organization

All this was accomplished at an annual cost that averages less than a half percent of the salaries of the engineers involved.

The individual offices for project engineers appear to be quite small, since they are only 8' 2" wide by 10' 8" long, or 87 square feet. The basic idea was to provide the engineer with a private and efficient work station. If he needs to confer with more than two people, he is expected to make use of the conference room. A conference room large enough to accommodate 10 or 12 people has been provided in each of the three engineering wings. These are in addition to the main conference room situated on the third floor ad-



Building is equipped with year-round air conditioning controlled from this panel in mechanical room.

acent to the administrative offices. Each of the four conference rooms is provided with a 4-ft x 6-ft magnetic type blackboard and a 4-ft x 12-ft cork tack board.

#### Reproduction Area

Facilities in the reproduction area occupy about 3500 square feet and provide a complete service for the preparation of reports, specifications, and plans. Camera equipment is used extensively for negatives in connection with lithographic reproduction of report exhibits (including color work), as well as in the preparation of half scale drawings. These reduced scale drawings are used for bidding purposes almost exclusively. Much use of the camera also is made in assembling the details for final working drawings, a time-saving technique known as "scissors drafting."

The space allocation in square feet for the various reproduction facilities are as follows:

Camera room and dark rooms	850
Multilith room for four machines, also sorting and folding facilities	800
Varityping, light tables, etc.	350
Checking, binding, trimming, etc.	550
Print room for B-W machine	220
Control office	230
Mail room	260
Paper storage	140

#### Central files and Storage

A central files department having a floor area of 1200 square feet was established in the new office. The principal items which are kept permanently in this area include:

- ¶ Design notes, report notes, conformed copies of specifications
- ¶ Tracings of completed projects
- ¶ Shop drawings
- ¶ Project correspondence
- ¶ Bid sets
- ¶ U.S.G.S. maps
- ¶ Drafting supplies
- ¶ Extra copies of specifications and reports
- ¶ Office supplies
- ¶ Reduced prints of "As Built" drawings
- ¶ Instruments
- ¶ Field books
- ¶ Reference prints
- ¶ Aerial photographs

Regular pickup and delivery rounds are made hourly throughout the office for items filed in the central files department or in the library. Special requests are handled by telephone. Six file clerks are on duty during regular hours. One clerk is on duty on Saturdays. Every effort is made by this de-

partment to eliminate wasted time by technical personnel using the files and library.

#### Library

The library and adjoining work room have a floor area of 730 square feet, ample space for orderly filing of the following items:

- ¶ Reference books
- ¶ Catalogs
- ¶ Periodicals
- ¶ Technical files
- ¶ Record copies of engineering reports
- ¶ Various society and association standards
- ¶ Water supply papers
- ¶ Federal specifications

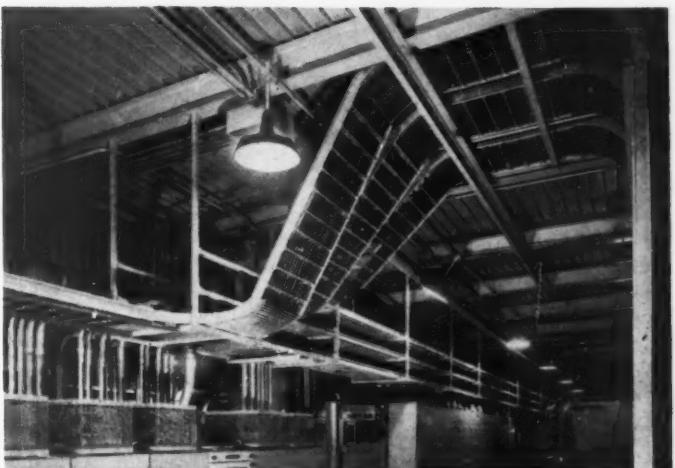
The librarian and one assistant are on duty during regular hours. The Dewey decimal system is used for filing reference books. The AIA filing system has been adopted for catalogs, except that the system has been expanded materially. This is particularly true in the case of electrical and mechanical literature.

#### The Coffee Break

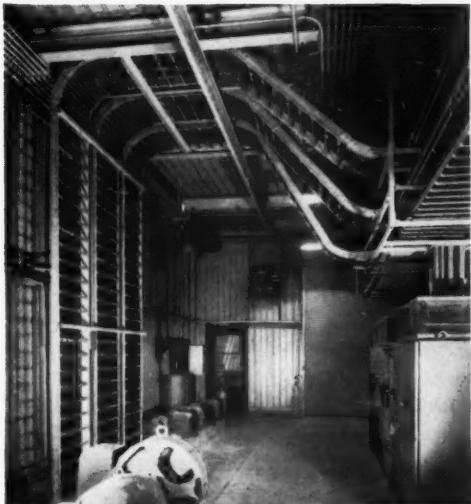
The modern trend in business offices is to establish regular coffee breaks. Almost as much importance is now attached to these recess periods as to the regular lunch period. It was decided that this matter should be given very realistic consideration in the design of the new office facilities. Accordingly, a recreation room with tables and chairs to accommodate about 80 people has been provided. Two, 10-minute coffee breaks are permitted each day. The breaks may be taken at the individual's discretion between 9 a.m. and 11 a.m. and between 2 p.m. and 4 p.m. Two lunch periods are used, 11:45 a.m. to 12:45 a.m. and 12:15 p.m. to 1:15 p.m. The first lunch period is taken by all personnel who leave the building for lunch. Those bringing lunch are divided into two groups, the first of which is required to vacate the recreation room at the end of the first half hour. The recreation feature is primarily confined to card playing which occurs during the lunch period only.

The economic features of the coffee break situation are quite elusive. However, it does appear certain that the time consumed is not a total loss. It is felt that an individual's over-all efficiency is improved somewhat by leaving his station for the walk to and from the recreation room. Actually, in many instances, the break is used to discuss business matters by employees who would otherwise tend to lose contact had they remained at their respective stations. Hence, the coffee break has been officially sanctioned, and a constant effort is being made to use the brief get-together to the best advantage of the organization. ▲▲

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# Steel Code Leaves Opening for Price Disputes



GREER W. FERVER  
Structural Engineer

*Greer W. Ferver's interest in engineering codes is evidenced by his current activity as chairman of the building code committee of the San Diego Section of ASCE and the Structural Engineers of San Diego. He is also active in the Structural Engineers Association of Southern California. A graduate of the California Institute of Technology, Ferver did advanced work at Pennsylvania State College where he earned an M.S. degree. Presently in private practice, he brings to the profession a broad background in diversified design work. He is registered in California as a civil, structural, and mechanical engineer.*

## THOUSANDS OF CONTRACTS

are written every year to cover the purchase of structural steel — one of the most popular and useful construction materials — for all kinds of engineering projects. Such contracts generally are drawn up on the basis of universally understood standard practices within the industry. There is, however, one type of contractual agreement that frequently leads to costly misunderstanding, either to the purchaser or vendor, because a vital point is not specifically covered. This type involves the computation of weights as the basis for billing when the required material is to be secured from the fabricator's own stock or from a local warehouse.

Publications of the American Institute of Steel Construction, in whole or in part, usually are incorporated directly or by reference in most contracts for steel fabrication. The *Code of Practice for Steel Buildings and Bridges*, with revisions from time to time, has been the standard of steel fabricators since 1924. The Code defines structural steel and outlines the services ordinarily performed by fabricators and erectors, but one important omis-

sion from the Code should be known and understood by all who enter into contracts for the purchase of structural steel.

Structural steel most often is purchased by one of two alternate methods: lump sum contracts and price per pound contracts. When steel is purchased by the pound, the actual weights of the fabricated material furnished seldom are used. Weighing of the finished pieces to be incorporated into a structure involves time and expense in using public scales, which are not always available, and attendant accounting problems, which it is desirable to avoid. Instead, the Code stipulates an arbitrary method of calculating weights for payment that is used almost universally.

Inasmuch as structural steel includes a diversity of items, various methods of computing the weights of each kind of material are specified. While complete information may be found by referring to the Code, the following portion of the current Code, as adopted on June 26, 1956, illustrates the pitfalls of price per pound contracts.

"Weights for shapes, plates, bars, castings, rivets, bolts, and weld metal are calculated on the basis



of detailed shop drawings and shop bills of materials showing actual dimensions of materials used as follows:

1. Weight is calculated on the basis of rectangular dimensions for all plates and ordered over-all lengths for all structural shapes from which the required material is cut, without deduction for copes, clips, sheared edges, punchings, borings, milling, or planing. When parts can be economically cut in multiples from material of larger dimension, the weight is calculated on the basis of the dimensions of the material from which the parts are cut."

The Code that was in use just prior to the 1956 version contained a footnote to the above that read: "This is based on the usual practice of ordering material from the rolling mills to the nearest available dimensions. When material, obtained from local sources, involves unusual waste, special terms of the contract shall be agreed upon."

#### Omission Hurts Code

This footnote had not been incorporated in the other earlier editions of the Code. It was added in an effort to call attention to the need for a specific provision in such agreements. It served its purpose well. The omission of this footnote in the current Code is therefore a backward step and has led to a return to the confusion and misunderstanding that results from failure to be specific.

Nearly all steel fabrication contracts involve some material that will be purchased from a local warehouse supply or be taken from the fabricator's inventory. Most small jobs, and many large jobs where especially fast delivery is required, will use only material from the local sources. Use of this material frequently will involve uneconomical cutting with consequent returns of material to the stockpile or scrap heap. When purchasing steel in

circumstances that require the use of such local sources of supply, it is essential to clarify the intent of the phrase "ordered over-all lengths" as used in the Code.

"Ordered over-all lengths" is subject to two interpretations. The first, as apparently contemplated by the writers of the Code, is the actual cut length of a piece to be incorporated into the work. This length is shown on the shop drawings and bills of materials. The second interpretation is the length of the ordered raw materials from which the finished piece is cut — also frequently shown on the bills of materials. Often the two interpretations yield the same result; often they do not.

General practice on the part of the fabricator involves a prior estimate of the amount of steel to be returned to his inventory or scrapped as a result of cutting available supplies of raw materials and the inclusion in his quoted price per pound of an allowance for the scrap involved. Should a fabricator base his bid on a computation of weights that assumed all excess steel would be included in the payment weight, his price per pound obviously would be lower. The customer then would be billed for the full lengths of raw materials ordered; such billings often are far in excess of the amounts envisioned at the outset by the buyer.

#### Weight Computation Dispute

Recently I acted as consultant to one of the principals involved in a dispute arising from the purchase of structural steel by the pound. The disputed amount was many thousands of dollars, representing the difference in pay weights resulting from applying the two possible interpretations of the Code. A request to AISC for an official interpretation of the questionable phrase brought the following reply:

"The present Code, by omission of the footnote referring to material obtained from local sources, which had been contained in the previous Code prior to its revision, does not cover the cases where unusual wastage is encountered. As different fabricators bidding a specific job requiring material to be secured locally possibly use different sources of supply, their calculated wastage would be dependent on the suppliers stock dimensions. It therefore is most important, as your present experience demonstrates, that when a contract involving the furnishing of local materials is let on a pound price basis the method of computing weights for that particular job should be understood at the time it is negotiated."

Clearly we have here a situation where the consulting engineer must protect his client. Failure to do so can lead only to serious differences, which are always costly to resolve. ▲



Baltimore & Ohio R.R.

*Typical truss bridge, of the type designed by Wendell Bollman, of the Baltimore & Ohio Railroad, erected in 1873.*

## America's First Iron Bridges

RICHARD SANDERS ALLEN

IT SEEMS STRANGE TODAY that structural iron was not used much by bridge builders until just over a century ago, but engineers then had little

**CE exclusive**  
knowledge of the properties of cast and wrought iron. They were cautious about using, without proof of strength, so light a substance. More important, wood was plentiful and men with some knowledge of carpentry lived at every crossroads hamlet.

The idea for iron bridges came from Tom Paine. Famed and revered for his patriotic pamphlets which crystallized sentiment in favor of the Revolutionary War, Paine simultaneously was hotly damned for his low opinion of organized religion. Yet, between his political and religious agitations, Paine designed an iron bridge intended for use across the Harlem River north of New York City.

As a boy in England, Paine had learned the trade of staymaker, and some of the principles of support found in the whalebone of bodices were applied to the iron components of bridges. His

idea was to use open structural cast iron segments as the voussoirs in an arch—a construction method similar to the one that stonemasons had been using for bridges for centuries.

By 1786-87 Paine had built three models of his bridge design. Because Manhattan was not interested, Paine transferred his energies and his bridges to Philadelphia. There he planned to span the Schuylkill River. Combining pragmatism with patriotism, Paine suggested an arch bridge of 13 ribs, one for each of the original states.

Philadelphia also was to cool to Paine's bridge building schemes. Then, as the result of a political squabble, the inventor left the United States for England and France, taking a wrought iron model along with him. European scientists raved over the bridge, and Paine took out an English patent. He had a 110-ft bridge cast by a Yorkshire foundry and exhibited it in a London park.

Almost immediately Paine got embroiled in the French Revolution, and his bridge was sold to

satisfy his creditors, among them the Walker Foundry which built it. The Walkers incorporated the materials in the 236-ft Sunderland Bridge at Wearmouth, England. The man in charge of construction, Rowland Burdon, even took out a new patent on the cast iron voussoir plan originally devised by Paine.

After a miraculous escape from a Paris prison (every night an officer went along the rows of cells chalking the doors of those who were to be guillotined, but Paine was spared because his cell door was chalked when it was open and the mark was not visible when the door was closed) Tom Paine returned to America and pleaded in the public press for government financing of a 400-ft cast iron arch. But Congress was strapped for money, and individual companies showed no interest for they were busy erecting wooden toll bridges.

Though bridge builders used iron bolts and an occasional stiffening rod to fasten massive timbers, nothing in the way of an all-iron bridge was attempted for 30 years after Paine. Then in 1833 a patent was issued to Augustus Canfield, of Paterson, New Jersey (a Lieutenant of the U. S. Army Engineers assigned to duty with the Paterson & Hudson River Railroad) for an iron truss bridge on the multiple-kingpost plan. Each truss of this "tension iron bridge" consisted of two string-pieces, one above the other, connected at each joint with vertical bars and cross braced with cast iron diagonal members. The upper chords were hooked and held transversely by bent rods imbedded in masonry abutments, and the lower chords supported the bridge flooring.

#### America's First Iron Bridge

The first known iron bridge in the U. S. was a product of circumstances. Over Dunlap's Creek, at Browns-



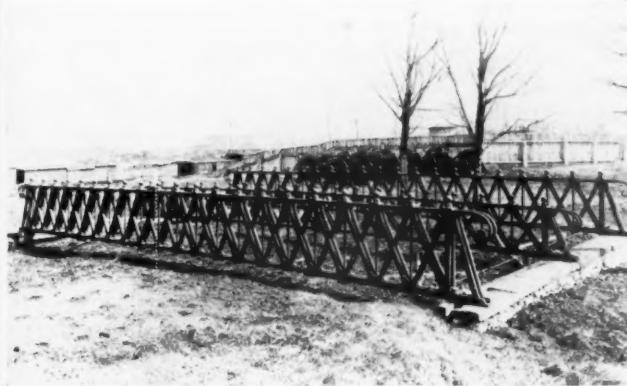
Brownsville, Pa., C. of C.

*First cast iron bridge erected in America went up in 1836 over Dunlap's Creek, Brownsville, Penna.*

ville, Pennsylvania, there had been a succession of bridges, including several wooden ones and even an early suspension type built with wrought iron chains. The stream was across the route of the National Road, part of the great system of internal improvements advocated by Henry Clay. Traveling the route on an inspection trip, Clay was dumped into the creek when his carriage overturned on the rickety wooden bridge. Battered and soiled but not much hurt, Clay scrambled up the bank, quipping, "Mud and Clay shall not be mixed in this place again!" He made certain that the next National Road appropriation had funds earmarked for a new and better bridge at Brownsville.

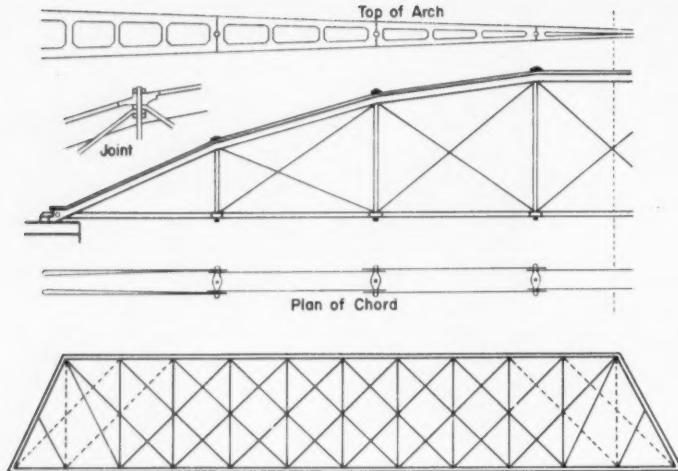
Captain Richard Delafield, of the Army Engineers, was in charge of this section of the National Road. He knew the general details of the English iron bridges, and it seemed strange to him that no one had built one in America. The owner of Snowden Iron Works, at Brownsville, John Snowden, was willing to attempt the necessary castings. John Herbertson, foreman at the iron works, proved an excellent draftsman, and with the assistance of Delafield and two lieutenants, Cass and McKee, the proposed bridge took shape on paper.

Snowden's foundry made 250 castings for the span and received \$39,901 for their pioneer work in structural iron. The cast iron arch they made is the famous Dunlap's Creek bridge at Brownsville, which still carries the heavy traffic of U. S. 40. The bridge has a span of 80 feet, with an 8-ft rise to the arch. It is a deck job: the casual observer must get down in the creek bed to ap-



The Reading Company

*Richard B. Osborne's original iron Howe truss span. First all-iron railroad bridge built in America.*



Union College

*Squire Whipple, of Utica, New York, was the designer of both bowstring and trapezoidal truss iron bridges.*

preciate the five arch ribs, made up of hollow elliptical iron tubes. Each rib is composed of nine equal segments fastened with  $1\frac{1}{2}$ -in. bolts. Between the arch ribs and the deck are spandrel supporters — an openwork of cross-hatched cast iron triangles.

#### First Parallel Truss Bridge Collapses

The first known parallel truss iron bridge built in the U. S. was erected over the Erie Canal at Frankfort, New York in 1840, the design of Earl Trumbull, of Little Falls, New York. Eighty feet long, it consisted of seven cast iron panels with diagonal braces and had hollow cylindrical posts at the ends. Employing the suspension principle along with the truss, Trumbull installed  $1\frac{1}{2}$ -in. wrought iron rods from the tops of the end post in a parabolic curve down under the wooden center floor beams.

The beams proved the experimental span's undoing. After five years they broke, twisting the trusses so the bridge fell into the canal. Undaunted, Trumbull rebuilt with cast iron beams. This structure lasted 30 years. Although Trumbull took out a patent on the truss arrangements, he died before he could promote any general use of the design.

Squire Whipple, a surveyor's instrument maker, was working on the canal system in the same up-state New York area. In 1841 he devised an arch bowstring truss bridge with compression members of cast iron and tension members of wrought iron. The first one was erected in the winter of 1841-42 over the Erie Canal, on First Street, in Utica.

Not satisfied, Whipple scraped together \$1000 of his own money to put up a better example in a more prominent position over the canal, at Newville, near Rome. A few contractors began to

build on the plan, paying the inventor royalties for the use of his patent, and the bowstring became a feature of canal towns like Albion, Holley, Brockport, and Rochester.

#### Political Chicanery

Within a few years the Erie Canal Board, in an enlargement program, adopted the Whipple bowstring arch as a standard road bridge. Unfortunately, politically potent contractors got the bridge contracts and had the plans declared state-devised and royalty-free. This left Whipple out in the cold. For years he demanded payment, complaining, "These little bridges, I invented; but Ratty gets the pay!" Whipple bowstring bridges were erected all over the East, but their inventor received little or no royalties from their design.

Whipple is remembered more for what he wrote about bridges than for his designs. His book, *A Work on Bridge Building*, first published in 1847, was in print for 52 years as a standard reference. This volume is his best monument; because of it Whipple is credited "without precedent or example, of evolving the scientific basis of bridge building in America."

#### Adapting Wood Bridges to Iron

By the 1840s American railroads were beginning to spread out in all directions, and something more permanent than wooden bridge trusses was needed. Experiments were made in adapting the patent wood trusses to iron.

The first successful bridge of this type was devised in 1844 by Richard B. Osborne, chief engineer of the Philadelphia & Reading Railroad. An Irish-born engineer, Osborne took the wood and

iron trussed panel design (patented in 1840) of his friend William Howe and made a small bridge completely of iron. This span, only 34-ft long, had three trusses. Chords were of wrought iron connected by cast iron braces and angle blocks. The actual superstructure was built in the Reading's Pottstown shops and erected on May 3-4, 1845 over a small stream and public road near West Manayunk, Pennsylvania. First of several similar bridges built by Osborne for the Reading, it stood until 1901. Its middle truss is preserved in the Smithsonian Institution.

New developments in iron railroad bridges came fast. Frederick Harbach, another friend and business associate of inventor William Howe, took out a patent on an iron Howe truss in 1846, using cast iron for the top chord and braces and wrought iron for the lower chord and vertical rods. A 30-ft bridge of this style was erected in 1846-47 on the North Adams branch of the Western (Boston & Albany) Railroad, located in the area north of Pittsfield, Massachusetts.

Shortly thereafter, onetime Howe business partner Daniel Harris built another iron Howe truss bridge spanning the Seekonk River on the Boston & Providence (New Haven) Railroad. Down in Maryland a fourth Howe associate builder, Daniel Stone, erected a 32-ft iron Howe bridge over Harford Run, in Baltimore. This one was designed with a width totalling 66 feet, and had five trusses supporting a highway surface with a railroad track running down its center.

Also in Baltimore, James Millholland, machinery superintendent for the Baltimore & Susquehanna (Pennsylvania) Railroad, was readying the nation's first iron girder truss bridge, a heavy rectangular tube of boiler plate six feet deep. Millholland hung it between two flatcars and carried it 19 miles up the line to the bridge site. Here an old wooden bridge was cut away, and the 14-ton 55-ft girder

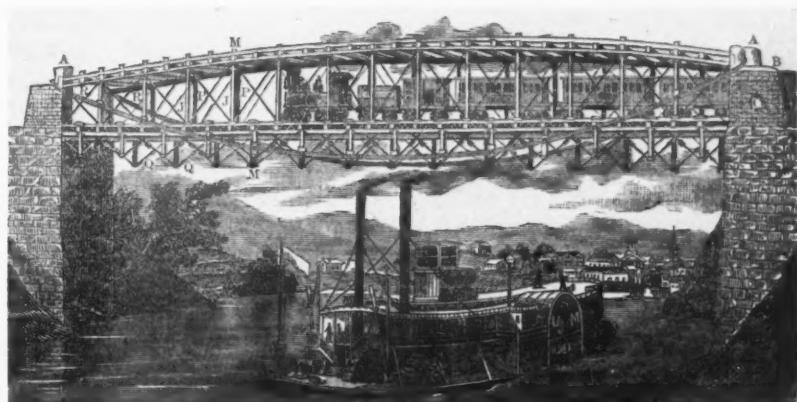
was lowered onto the stone abutments. The whole job cost only \$2200. Millholland later claimed that English engineers got their idea of massive tubular iron bridges from designs developed by him.

One American bridge definitely copied by British, French, and German builders was the wooden lattice truss devised by Ithiel Town in 1820. The Europeans built it of iron, particularly for railroad bridges, riveted or bolted together in a close-packed web of latticework strips. Though Town "suggested" his bridge could be built of iron, it was not tried in America until the 1850s, when Howard Carroll introduced riveted iron lattice web bridges on the New York Central Railroad. Though these iron bridges were widely used in Europe for 50 years, only a small number were designed and built for use in this country.

In 1845 Nathaniel Rider, of Worcester, Massachusetts, patented an iron web truss with multiple vertical posts and diagonal ties. The top chord and posts were cast iron, the lower chord and diagonals wrought iron. Between 1847 and 1850 a number of these Rider patent bridges were built. The first, a 70-ft span, carried the Harlem Railroad over 109th Street in New York City. There were others on the Harlem and Erie Railroads. The Louisa Railroad, in Virginia, had a 355-ft bridge with three spans. In New York State the bridge design was used primarily on the old plank roads and for spanning the historic Erie Canal.

#### Bridge Failure Conclusive

The end of Rider bridges came shortly after the inventor's early death. One at Lackawaxen, Pennsylvania, collapsed on a hot July day in 1850 under a moving Erie passenger train, killing several. Investigation showed that the bridge had been built so tight against the massive stone abutments that the expansion of the iron because of the heat humped and fractured the trusses. Du-



*H. L. Hervey of Illinois and R. E. Osborn of Ohio were issued patents for this design on August 21, 1855. It anticipated the lenticular girder.*

bious of iron bridges, the Erie ripped out its other Rider spans, plus some Whipple bowstring bridges that had been built at Binghamton and on the Newburgh branch.

The Rider company failed, but Whipple, bald and gray-bearded, gamely weathered another setback. In 1852 "the philosophical instrument maker," as he termed himself, came up with an iron bridge especially for railroads called "Whipple's Trapezoidal Iron Truss." The first one was built for the Albany, Vermont & Canada (Delaware & Hudson) Railroad on its main line near West Troy (Watervliet), New York, spanning the Erie Canal just below a huge double stone lock. The bridge angled on a 60-degree skew across the canal, with a 149-ft clear span. It had inclined 9-in. tubular end posts, something new in iron bridges. The top chords and posts were cast iron, the lower chord was wrought iron links. A web, rather than a panel system, was used in the truss with the wrought iron web rods connected by pins in the chords. Whipple also built bridges located at Utica and Boonville, New York, over the course of the succeeding two years.

Despite these efforts, the famous engineer James Laurie, first president of ASCE, gave a dubious report on them in 1856: "Wooden bridges may be safely used, but those of iron are inadequate to the stress to which they will be subjected." Time, however, vindicated Whipple and changed Laurie's opinion. Under the pounding of increasingly heavy rolling stock, the West Troy bridge served until 1883. The 123-ft Utica bridge over the Mohawk River had an even longer life. During a freshet it was carried away, but pieces were fished up and put in place again, with broken ones replaced by new. These were the first of many specimens of Whipple's "trapezoidal trusses." Quite a number of these structures still are in service today.

#### Success Varies

Of the patented "wooden-turned-iron" trusses that flourished in the 1840s and '50s, only two made a really successful transition. One was the Pratt truss (1844), first designed in wood by T. Willis Pratt, of Boston, Massachusetts; the other was the Warren truss (invented either by James Warren of London in 1848 or by Russell Warren of Providence, Rhode Island about 1851). Both Pratt and Warren trusses, never popular in their original wooden version, are being designed with both iron and steel today.

Other designs experienced varying degrees of success. In fact, in 1852 Julius Adams, editor of *Appleton's Mechanics & Engineers Journal*, (himself a bridge designer) caustically wrote: ". . . unfortunately . . . our bridge builders are too intent

on inventing new forms to spare much time for the study of the principles . . . The Patent Office record abounds in projects for self-supporting structures, most of which have failed in sustaining their inventors."

Among these were B. Severson's iron bridges (1852), which was about as strong as the hoop-skirt iron which went into its trusses. Then there was a spiral-braced iron cylindrical bridge of Isaiah Rogers (1841) which attempted to enclose the roadway in a tubular network. Even more fanciful were Thomas Durden's (1858) truss of interlocking roadway tubes, and Ammi White's (1852) conglomeration of cable suspension, covered wooden span, and cantilever truss, all in one bridge.

More successful was the patented iron truss bridge invented in 1852 by Wendell Bollman, of Baltimore. Built extensively on the Baltimore & Ohio Railroad, where Bollman was "master of the road," the design dominated the railroad bridge field in Maryland and Virginia for 20 years. The first Bollman bridge, at Harper's Ferry, was of cast iron, with wrought iron diagonal rods extending from each lower panel point to the upper ends of the posts, making it a type of suspension bridge.

A similar structure, which eliminated the lower chord entirely when used as a deck span, was devised two years later by Albert Fink, Bollman's German-born assistant. Like many bridge designers before him, Fink used test models. His workshop was a clutter of tin and wire snippings, with miniature bridges in all stages of construction — and after load tests — destruction. Fink's bridge was popular for long, multiple-span railroad viaducts for a quarter of a century. Fink also introduced iron piling for railroad trestlework.

Of some success was the triangular tubular arch (1857) of Kentucky's Thomas W. H. Moseley. Over 200 of them were built in 13 years. Lucius Truesdell, of Warren, Massachusetts, had a good wrought iron truss of small superimposed panels (1856), and Francis Lowthorp, of Trenton, built some patent (1857) wrought iron trusses with large panels which still stand in New Jersey and Pennsylvania. In the midwest Horace Hervey, of Quincy, Illinois, and Robert Osborne, of Springfield, Ohio, first patented (1855) the "lenticular bridge," a flat elliptical truss which became popular with the William Douglas "parabolic" patents of the 1870s. These and other minor inventor-builders in iron completed an era of bridge building that came to an end with the Civil War.

The time was fast approaching when huge steel truss, cantilever, arch, and suspension spans would dominate American bridge building. Paine, Delafield, Whipple, Bollman, and their colleagues had shown the way. □

New Cleveland water filtration plant  
is Powered-Up to serve industrial  
and residential expansion

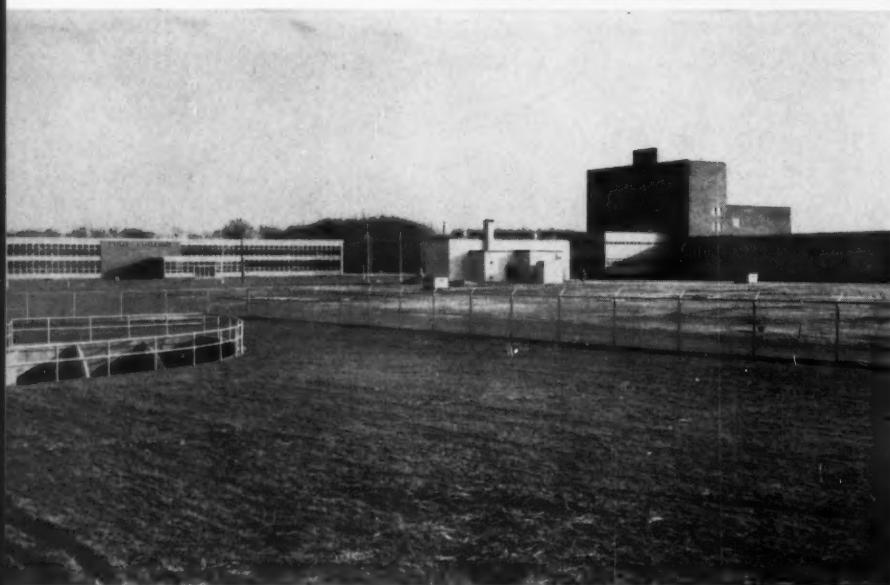
YOU CAN BE SURE...IF IT'S **Westinghouse**

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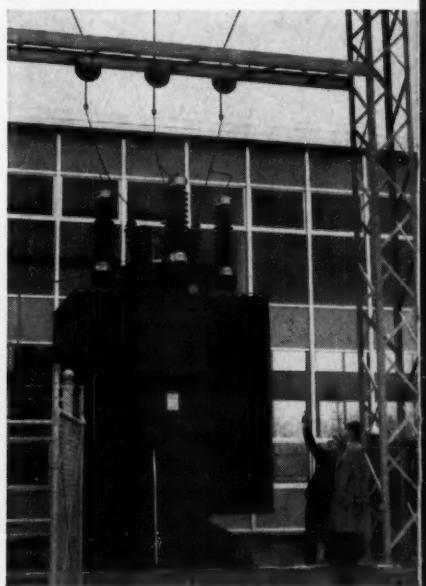
View of raw water pump suction wells illuminated by Westinghouse VEK-16 floodlighting.

Project group discussing layout of Crown Filtration Plant includes J. E. Hrovat, Vice President of Engineering, Doan Electric Co., Electrical Contractors; E. E. Croushore, Westinghouse Construction Sales Engineer; L. O. Meyer, Branch Sales Manager, WESCO, Cleveland; Dan Kasych, Assistant Superintendent, Pump Building; G. L. Baughman, Chief Electrical Engineer, Havens and Emerson, Consulting Engineers; S. C. Simmermacher, Chief Mechanical Engineer, City of Cleveland; M. B. Trimble, Westinghouse Construction Sales Engineer; E. S. Goulder, President, Doan Electric Co.; and H. M. Stafford, Salesman, WESCO, Cleveland.

J-94123-2



Over-all view of Crown Filtration Plant, Cleveland, Ohio. Pump building is at left and the filter building at right. Westinghouse OV-20 street lighting was provided for plant entrances and roadways.



Dan Kasych and E. E. Croushore examine one of the two Westinghouse 5000-kva power transformers which step incoming 34.5-kv service down to 4160 v for main pump drives.

# Westinghouse system provides for 100% electrical load increase in new water pumping station

The new Crown Filtration Plant was designed to meet the growing need for water supply in the westerly suburbs of Cleveland, Ohio, and, as an important part of that planned expansion, the Westinghouse electrical system presently installed provides for 100% load increase without adding to the system.

The pumping station-filtration plant is located on a 55-acre site and is the newest addition to the city's expanding water supply system. Construction was started in 1953 and completed in 1958, and represents nearly a \$20,000,000 investment. Present plant capacity is 50 mgd; but, because of anticipated future requirements, the plant has space and provision for additional equipment to provide capacity of 100 mgd.

Raw water is obtained through a crib 2½ miles offshore in Lake Erie. The water from the crib is carried through a connecting tunnel to a raw water well, where its handling is taken over by raw water submerged pumps. Treatment and flow of the water from this point through the filtration plant are automatic and exactly controlled, leading finally to a 15-million-gallon filtered water reservoir located in the southwest corner of the plant area. High service pumps deliver the water from the reservoir to both the low pressure zones and the first high pressure zones supplied by the Crown plant.

The major electrical elements supplied by Westing-

house to Power-Up this filtration operation include:

Two 5000-kva power transformers—to step utility service from 34.5 down to 5 kv.

Main metal-clad switchgear—to control and distribute power to motor starters (for L.S.) and provide for starting of H.S. motors (1750 hp).

Dry-type power center—to provide 480-v service to plant auxiliaries.

Westinghouse lighting throughout the plant area, including fluorescent, incandescent, street lighting and floodlighting.

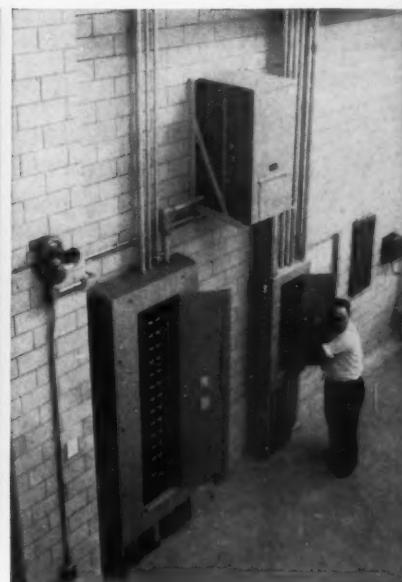
In addition, Westinghouse supplied the many lighting and distribution panelboards required in the plant's operation.

The planned Powering-Up of the Crown Filtration Plant means it can meet all foreseeable future requirements with a minimum of modification. Additional water handling and treating facilities can be installed in areas already provided for them. And all such additional equipment can be operated without adding to the existing electrical distribution system.

(contd.)

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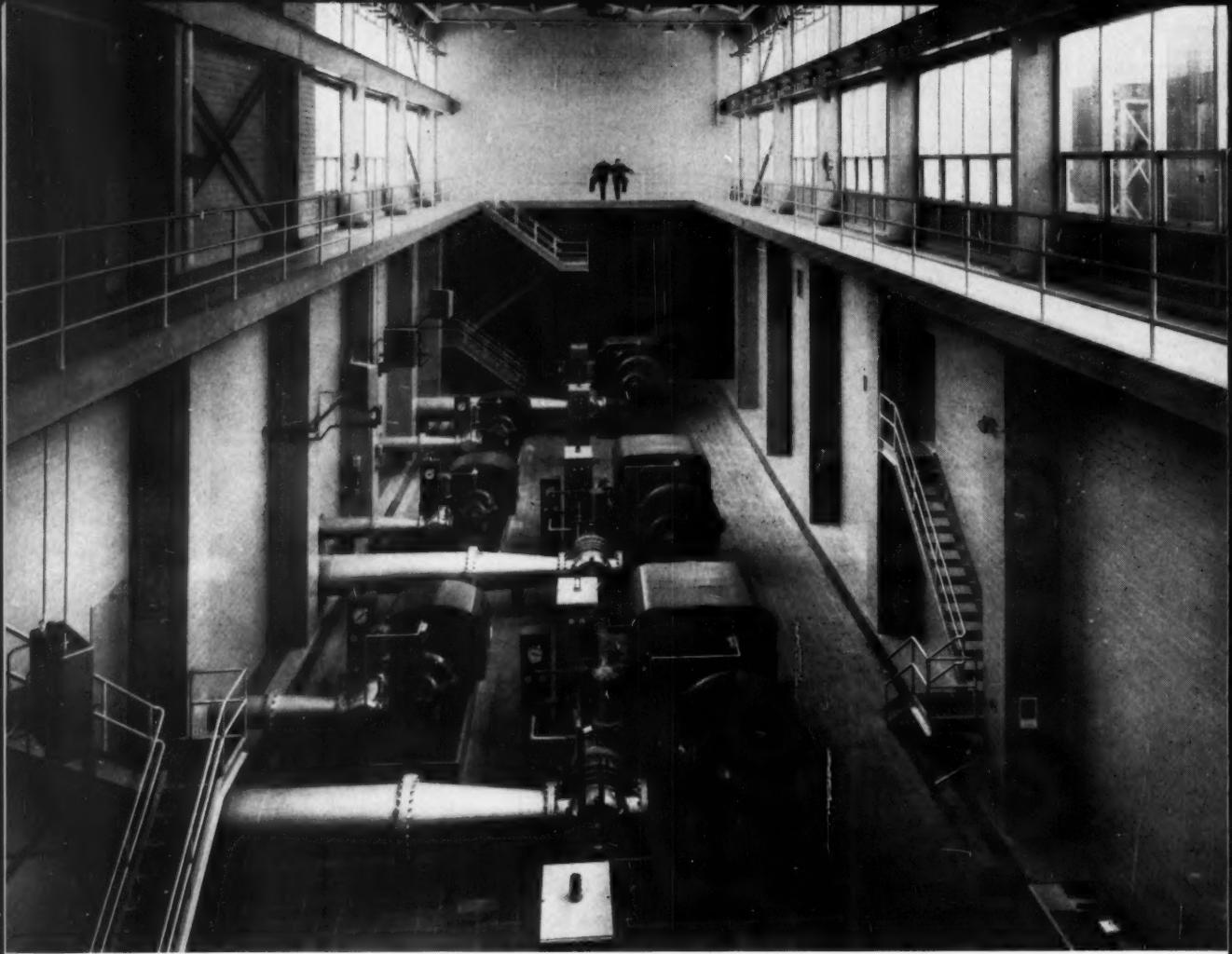


View in main switchgear room with G. L. Baughman, M. B. Trimble and S. C. Simmermacher examining Westinghouse metal-clad switchgear. Lineup at right contains main incoming line breakers, bus tie breaker, reactor starters for high service pump motors, and feeder breakers for power center and low service pump motor starters. Five-kv bus duct overhead provides connections from metal-clad switchgear to Ampgard\* high-voltage fused starters at left.

\*Trade-Mark

Dan Kasych inspects switchgear room. Westinghouse 225-kva power center utilizes dry-type transformers and DB low-voltage air circuit breakers to supply power panels throughout pump building. Room lighting is Westinghouse 2 SPC-75 slimline fluorescent luminaires.

Westinghouse CDP power distribution panelboard and wall-mounted 37.5-kva dry-type transformer feeding NLAB lighting panelboard. J-94123-3



(contd.)

## Electrical system provides for 100% load increase

Powering-Up electrically for future growth can mean important benefits and savings for you. For further information, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

J-94123-4

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CONSULTING ARCHITECT: Small-Smith-Reeb and Draz,  
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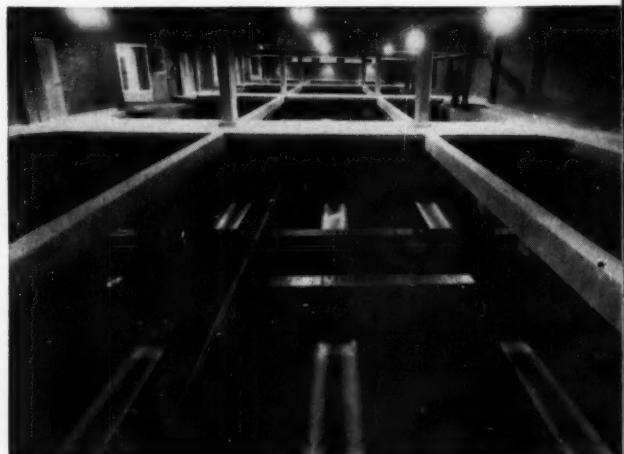
GENERAL CONTRACTOR: The Hunkin-Conkey  
Construction Co., Cleveland, Ohio

ELECTRICAL CONTRACTOR: Doan Electric Co.,  
Cleveland, Ohio

WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric  
Supply Co., Cleveland, Ohio

Section of main pump floor showing the three 25-mgd high service pumps and three 8-mgd low service pumps which are presently installed. Metal-clad switchgear cubicles and Ampgard high-voltage starters for these and two additional future pumps of each rating are installed in the main switchgear room. High bay mercury-vapor lighting is provided by Westinghouse Millite® luminaires.

View in filter building showing row of clarified water filter beds. Under average flow conditions, the 12 filters in the plant will pass a total of 50 mgd. Lighting is supplied by Westinghouse VEK-16 floodlights.



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# Westinghouse

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## Report From Canada

... problems of private practice  
are much the same on the  
other side of the border

MARJORIE ODEN, Eastern Editor

THE ASSOCIATION of Consulting Engineers of Canada annual meeting sounded **Cg exclusive** just like home, with discussion of membership requirements, increased dues, and expansion of government engineering personnel sharing the program.

Quite a difference from last year ("Canadian Consultants Complain of U.S. Competition," July 1958). Although it was mentioned that complaints have been made about two United States consulting firms' methods of operations, no action was taken. One member credited the increased volume of business with the decline of scorekeeping on neighbor engineers from the States.

### Membership Discussions

At present, a consulting engineer must have been a principal in a private practice firm for at least five years before he can be considered for membership in the ACEC. This is an unwritten agreement, which a number of members think should be liberalized to let an engineer who has been a principal in a consulting firm for three years be eligible for membership.

This is not a new topic of discussion in the Canadian group. The same question was voted down by the membership two years ago.

Some of the members, including President C. C. Parker, also are concerned about the guidance of the young consulting engineer who is just setting up his business. Creation of a junior or associate membership grade was suggested.

Under the ACEC constitution, membership requirements are a matter for the board to decide. The general membership merely was asked for an opinion. Although no decision has been reached, Parker explained later that "we definitely must make some changes in membership requirements. I am not satisfied that we yet have thought the matter through, and it will remain in the hands of committee for further study for the time being."

Advocates of letting down the membership barriers argued that it is important to get young engineers into the Association for purposes of guidance and of discipline. "After they have been in practice for five years without direct participation in the Association, there may be some antagonism to joining," it was pointed out. And as Parker added, "if we do not accept the responsibility for the young engineer in private practice, somebody else will."

"Look what happened in the United States," Parker continued. "The American Institute of Consulting Engineers failed to expand, so the Consulting Engineers Council was formed. This is a group with great vitality, recently recognized internationally as representing U.S. consulting engineers by being granted membership in FIDIC (International Federation of Consulting Engineers)."

John G. Frost, immediate past ACEC president and an Institute member, pointed out that this is not quite the entire story. The Institute often was asked to join FIDIC.

### Finances

When mention of the budget came up, Treasurer John H. Ross said the ACEC "is beginning to move, and moving takes money."

Currently, ACEC dues are \$50 per member. The group ended the past year in the black, but only by dipping into its reserves for about \$1000. A change in the Corporation charter took more time — and considerably more money — than anticipated. An attorney had to make the formal arrangements with the Secretary of State, in Ottawa, to allow ACEC to change the number of directors from six to eight. With this now done, the relatively new Prairie Chapter has board representation.

During the discussions of money, the arguments so familiar in the States were brought up. Why not charge by the number of employees in a firm instead of assessing each member the same amount? After considerable discussion, it sounded as if the

status quo will be retained, at least for a while. The matter was referred to the board for a final decision, as the Charter states it "shall be."

However, Ross predicted dues for the next year will be set at approximately \$125 per member. A special assessment of \$75 per member also may be required to provide funds for the remainder of this year. It was stressed that the assessment must be requested, not demanded.

#### Contacts With the Government

"Socialization" of engineers received a strong blast this year from ACEC. A brief was sent to the Prime Minister, objecting to the creation of government departments in competition with Canada's engineers in private practice. According to Frost, "evidence has trickled down that the brief might have done some good."

The Association plans to ask the Prime Minister's permission for the wide circulation of the brief to municipalities and other small government agencies. The brief merely sets forth a philosophy that government engineering should be aimed primarily at the fields of planning, maintenance, and operations. The Canadians also are contemplating circulation of New York City Park Commissioner Robert Moses' article on the advantages of government agencies using the services of consultants.

A study has been made as to the need for a Dominion-wide Tariff of Fees. Parker explained that Ontario currently is considering a revision in its fee schedule, and Quebec also is discussing the possibilities of modifications.

Although it was agreed that now is not the time to begin compilation of an ACEC Tariff of Fees (while the Dominion schedules are unsettled) Parker explained that ACEC is not giving up the idea of a separate schedule for the future. Even though the Dominion schedules might remain the basis for fees paid in Canada, an Association tariff could be recognized for foreign projects.

#### Public Relations

Public relations activities of the Canadian group this year included participation in two trade fairs — Trinidad and Jamaica. Distribution of a *Newsletter* was begun recently, and ACEC also had improved liaison with other consulting engineers associations.

During a discussion of ACEC growth, Parker mentioned that he recently attended the Consulting Engineers Council third annual meeting in New York City. The Canadian president said he was "impressed with the vigor" of CEC, pointing out that the work is distributed to the membership through about 50 committees, thus accomplishing a maximum effort. "This can serve as a challenge to us to organize ourselves to get more done through

committee." Ralph Westcott, CEC president, attended the Canadian meeting.

Parker also complimented the Canadian Council of Professional Engineers in similar terms, adding that he was happy to note the large number of consulting engineers taking an active part in the Canadian Council.

#### Work Abroad

At the Canadian's formal banquet, R. A. Firgon, chief of the engineering and equipment division, Department of Trade & Commerce, Ottawa, discussed "Engineering for Export."

Why should Canada export consulting engineers? "Any one country has a limited market, and Canada is no exception." And why should the engineer want to work abroad? "There are unlimited challenging opportunities," both financially and professionally, and Firgon said it is his understanding that engineers thrive on challenge.

How can the consulting engineer find foreign projects in time to be considered? Firgon suggested a number of methods:

¶ Cooperative effort among consultants through the formation of organizations to share the risks and expenses involved. This also increases the amount of necessary talent.

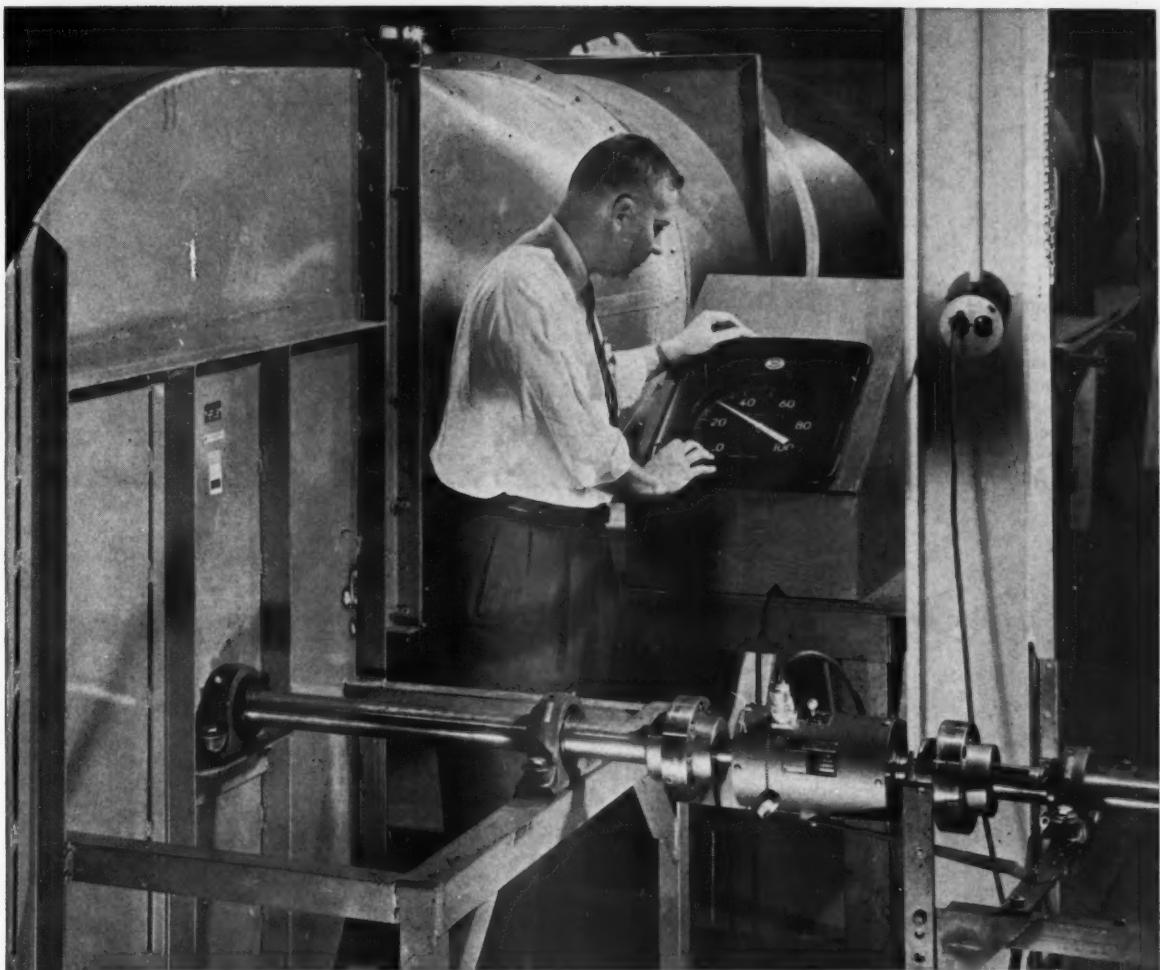
¶ Formation of a consortium — contractor, manufacturer, and a "form of consulting engineer who has ties with a manufacturer" — to work together.

¶ Through associations, such as ACEC, jointly searching for work in other countries by such methods as their recent trade fair cooperation.

¶ Through the government. The Department of Trade and Commerce has more than 50 stations, as well as headquarters in Ottawa, and will help the consulting engineer as much as possible. In order to expedite such services, the Department now allows Canadian consultants to deal directly with any of the stations, thus avoiding the delay of routing everything through Ottawa.

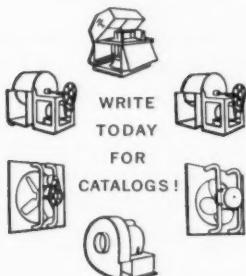
Firgon added that the Canadian consultant will find a warm welcome in most areas of the world. Foreigners tend to view Canadians as having risen from under the thumb of Britain. "We are active, but we have a tremendous potential not currently being exploited. Canada, in addition to being the mecca of hunting and fishing it is well known to be, also is capable of supplying the men and materials to develop other countries. We will not get the work by sitting home writing letters. Get out there and expose yourself to opportunity."

During the discussion period, one consulting engineer explained that he recently completed a project in Tunisia. "I have 75,000 Tunisian dinars I received as part of my fee," he said, "if anyone needs them." □



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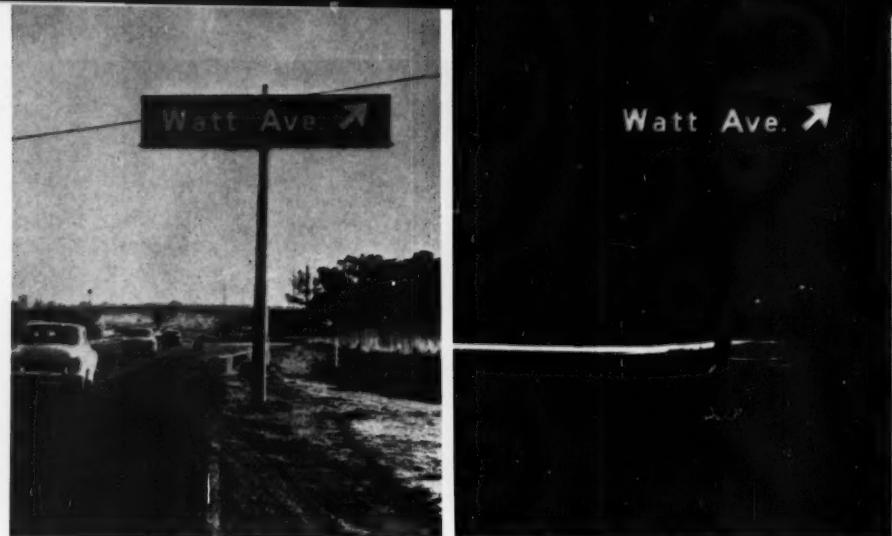


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## Where Can You Use Electroluminescence?

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now. As a high-level source for general illumination, it still has a long way to go. Research engineers, however, hope to have electroluminescent lamps comparable in performance to incandescent and fluorescent lamps within five years. With this in mind, consulting engineers can prepare for yet another light source offering interesting possibilities for a wide variety of new and unconventional applications.

The advantages of electroluminescent lighting are intriguing. These lamps can be made as extremely thin and rugged panels, can be cut to almost any shape, and even can be formed into flexible sheets. The theoretical efficiency may be higher than for either incandescent or fluorescent lighting. Light is emitted diffusely from an area source, as opposed to a point source (filament lamp) or line source (fluorescent lamp), and brightness and color can be controlled. Thus in general, no auxiliary light diffusers will be needed, although when high-level general lighting with electroluminescence becomes feasible, louvers may be required for visual comfort. Electroluminescent lamps also do not blow out or fail abruptly like more conventional lamps.

Rather, they ultimately require replacement only as the result of a gradual reduction in light output.

### Fundamental Principles

Although electroluminescence is not yet completely understood, it has been established that there are two fundamental types — recombination electroluminescence and field controlled, or acceleration-collision, electroluminescence.

O. W. Lossew, of Russia, first observed recombination electroluminescence in 1923 when he noted that a crystal of ordinary silicon carbide properly oriented between two pointed electrodes sometimes emitted visible light upon the application of direct voltage. This type of luminescence currently can be observed in a wide variety of crystalline materials. However, while only a few volts are required to produce light in some materials of this type, the system is presently too inefficient to be practical.

Field controlled electroluminescence, in contrast, utilizes a fluctuating field for excitation. Most development studies at the present time are focused on this approach and cover a wide range of voltages and frequencies. The method stems from experiments by Professor Georges Destriau, of France, who found that zinc sulfide phosphors suspended in an insulating oil between a pair of parallel plate

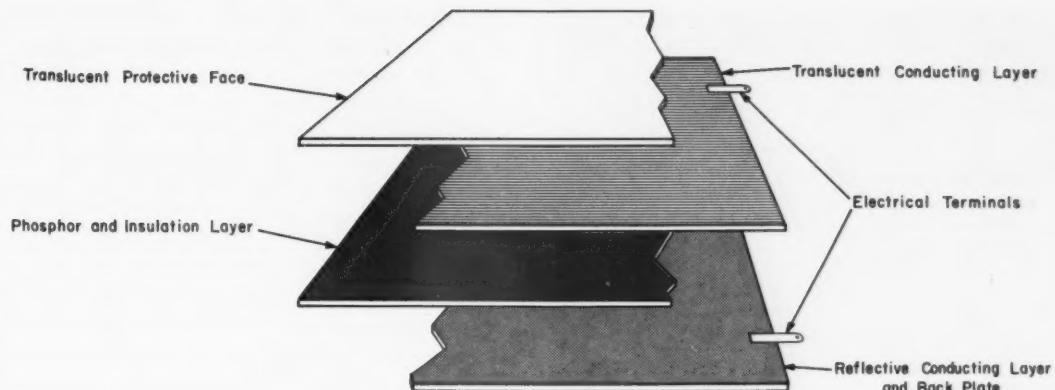


Fig. 1—Exaggerated schematic shows basic components included in the construction of an electroluminescent lamp. In standard production lamps, all of these elements are combined into a single thin homogeneous entity.

electrodes gave off light when an alternating voltage was applied to the electrodes.

Early experiments by Destriau with his luminous capacitor were regarded skeptically among scientific circles. Some doubted Destriau's explanations and suggested incorrectly that it came from microscopic arcs created within the phosphors. But following World War II, with the development of transistors and a subsequent better understanding of solid state physics and semiconductor theory, Destriau's field controlled electroluminescence aroused more interest. Since then, and particularly since the first demonstration of practical electroluminescent lamps was made by Sylvania at the Illuminating Engineering Society Convention at Pasadena, California, on August 23, 1950, great strides have been made in this country to improve both brightness and efficiency. Today, Westinghouse, Sylvania, General Electric, and Radio Corporation of America are spending as much money on electroluminescence research as they formerly spent on the early phases of fundamental fluorescent lighting research.

#### How It Works

Though field controlled electroluminescence fundamentally is the process of converting electric energy directly into light, there still is no uniform agreement as to the precise mechanics involved. Anyone who reviews the references listed in the bibliography will find that much empirical information has been developed through experimentation, but these data still are awaiting adequate interpretation. In fact, since the energy conversion takes place within solid phosphors, most research efforts are devoted to finding out a great deal more about the actions and behavior of these particular materials under various conditions.

In commercial practice, the typical electroluminescent lamp is essentially a flat-plate luminous capacitor. As shown schematically in Fig. 1, a one- to four-mil thick layer consisting of specially prepared crystalline phosphor powders suspended in a suitable translucent dielectric matrix is sandwiched between two parallel plate electrodes. The electrode on the front (illuminated side) and its protective facing are translucent; the side of the back electrode that faces toward the front of the lamp is reflective.

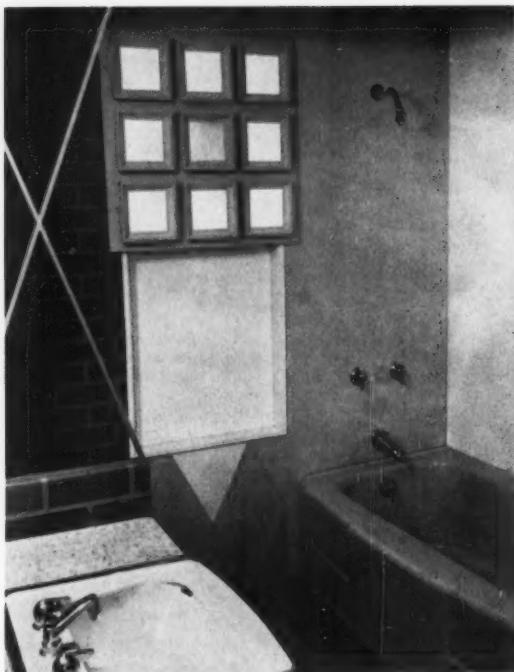
Alternating voltage is applied to the electrodes, setting up an alternating electric field across the phosphor-dielectric layer. Under the influence of this primary excitation, light is produced by the phosphors. For a sine wave impressed voltage, the light emission occurs in two main bursts per cycle.

While many factors have a bearing on the end results, the crystalline structure of the phosphors and the manner in which the phosphors are dispersed in the dielectric matrix are particularly important. At present most lamps use zinc sulfide phosphors, impregnated with an activator — usually copper — to form luminescence centers. Chlorine also is added to control the concentration of copper atoms. The phosphors are embedded in a dielectric matrix to increase the electric field strength and to prevent discharges in air.

#### Lamp Construction

Currently, there are two principal design approaches to lamp construction — glass-organic (plastics, such as polyvinyls) and metal-ceramic.

The front face of Westinghouse's "Rayescent" lamp is a sheet of ordinary single or double strength window glass coated with a thin film of tin oxide, a translucent conductor. Phosphor-dielectric mixture then is sprayed on the coated surface of the



All-plastic Monsanto House of the Future, located at Disneyland in Anaheim, California, includes a section of steel-ceramic Panelescent wall built by Sylvania.

glass, using several applications to obtain the desired thickness and uniformity, and cured in an oven. The rear electrode is a thin film of aluminum vaporized on the phosphor-dielectric layer. This aluminum back electrode also serves as an efficient reflector for light emitted in its direction as well as a protective coating.

Sylvania, after initial work using glass-organic designs, now is concentrating on steel-ceramic construction for its "Panelescent" lamps. The back electrode, a sheet of steel, is first porcelain enameled on one side using a white, highly reflective coating. A phosphor-glass frit mixture then is silk-screened onto the coated side of the steel, and furnace fired. A translucent top electrode is formed over the phosphor layer and it, in turn, is covered by a translucent insulator layer.

A glass-plastic electroluminescent lamp generally is acknowledged to be initially brighter, for the phosphor particles, which are sensitive to chemical attack, are affected less by the lower temperature baking process used in glass-plastic lamp manufacture. Advantages of the steel-ceramic type include ruggedness and, even more important, improved moisture resistance. Phosphors are damaged by moisture, resulting in short lamp life, and the high-temperature firing of the phosphor-glass

frit matrix gives a better humidity seal than generally is obtained with glass-organic lamps.

Flexible lamps can be made by coating the phosphor-plastic layer on conducting glass cloth or metal mesh. The second electrode can be vaporized aluminum. It is also possible to construct a completely transparent lamp that gives off light on both sides.

#### Factors Influencing Brightness

Brightness of electroluminescent lamps is a function of both voltage and frequency; raising either one increases the brightness. At present, the highest brightness obtained at 60 cps is 20 footlamberts; at 20,000 cps, a brightness of 2500 footlamberts has been recorded in the laboratory. For comparison, a cool white 40-watt fluorescent lamp has a brightness of about 2000 footlamberts. These maximum brightnesses are in green. White lamps exhibit brightnesses about half as high. Fig. 2 shows the variation in electroluminescent lamp brightness with changes in frequency at different voltages.

Theoretically, electroluminescent lamps can be made to operate at any voltage since field strength is determined by both the impressed voltage and the distance between electrodes. But the problems in the manufacture of uniform phosphor-dielectric layers are magnified by a reduction in thicknesses.

While the resistivity and dielectric constant of the base material are important, brightness pri-

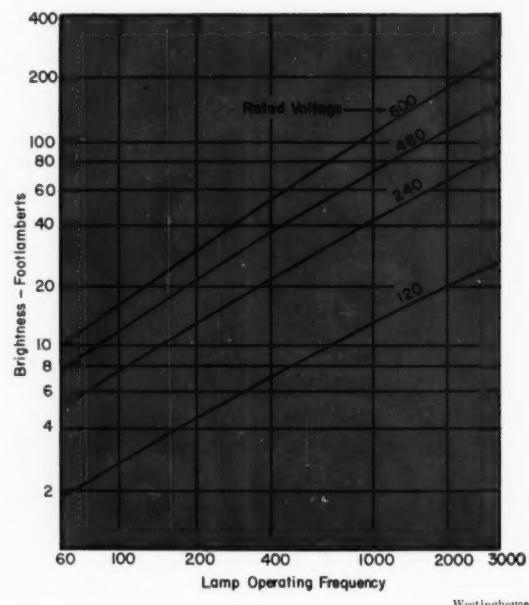


Fig. 2—Both voltage and frequency affect brightness of electroluminescent lighting. Brightness increases as voltage and/or frequency increases.

marily depend on the phosphor. To complicate development efforts, the best electroluminescent phosphors are not those that yield optimum results in fluorescent lamps. Also, the method of dispersing the activator in the crystalline structure of the phosphor and the phosphor particles within the dielectric — the temperature-time-atmosphere firing process — presents another set of parameters.

The brightness and electric power consumption of a phosphor also depend on the particle size of the phosphor. For constant amounts of phosphor energized under identical conditions, decreasing particle size significantly reduces brightness at low voltage. At high voltages, however, brightness remains the same or tends to increase. At all voltages, power consumption increases with increases in particle size.

### Efficiency

A most important property of any illuminating system is its lighting efficiency. Generally, a rule-of-thumb ratio between cost of power over usable lamp life and lamp cost is 10:1. Present electroluminescent lamps for general lighting applications will not fit this formula.

Optimum efficiencies unfortunately are not obtained in the frequency and voltage range for maximum lamp brightness. Presently the best efficiency — up to 16 lumens per watt (comparable to a 100-watt incandescent lamp) — occurs at frequencies between 500 and 1000 cps and at intermediate voltages. But brightness is low and the color is green. Comparable white electroluminescent lamps are only about half as efficient.

Fig. 3 shows laboratory efficiencies at different applied voltages and frequencies. At high brightnesses, efficiency is low; the green lamp which produces 2500 footlamberts operates at an efficiency of about 1 lumen per watt. In contrast, the standard cool white 40-watt fluorescent lamp producing nearly the same brightness exhibits an efficiency of 65 lumens per watt. Although it is felt that the voltage-frequency range for satisfactory brightness will more closely approach the optimum efficiency band in the future, lamp design at present is a compromise between brightness and efficiency.

The coefficient of utilization — the percentage of light produced that is available for seeing tasks — is higher than that of fluorescent and incandescent lighting, in some instances as much as twice as high. This is because reflectors and diffusers, which ab-

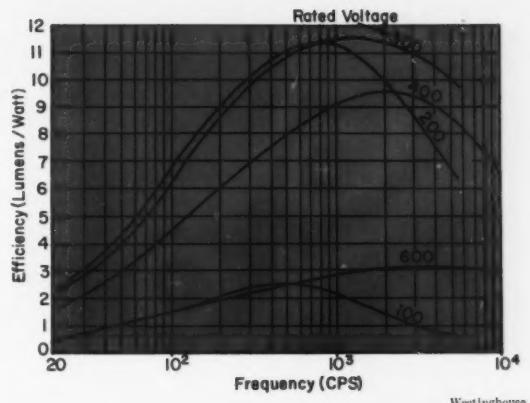
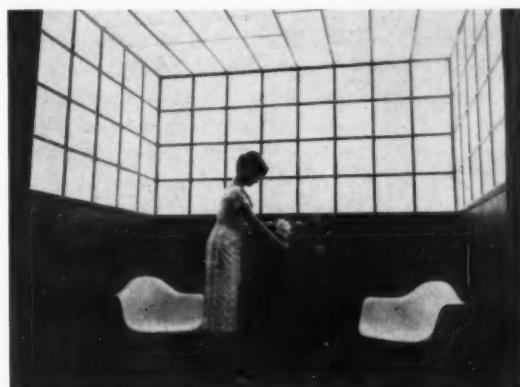


Fig. 3—Laboratory efficiencies at different applied voltages and frequencies. Present designs are compromise between maximum brightness, efficiency.

sorb light, normally are not needed. In addition, the theoretical maximum efficiency of this lamp may be higher than that of either an incandescent or a fluorescent lamp. These virtues offer hope despite the present low efficiencies and brightnesses of electroluminescent lighting.

The maximum theoretical efficiency of any light source is based on conversion of all its electrical input into a yellow-green light of a wavelength most sensitive to the human eye. This color would yield a maximum efficiency of nearly 700 lumens per watt. However, a good white light reduces this maximum obtainable efficiency to about 250 lumens per watt.

General service lamps currently available fall far short of this goal. The melting point of the tungsten filament limits the top theoretical efficiency of the incandescent lamp to about 50 lumens per watt. The fluorescent lamp appears to have a maximum efficiency of about 100 lumens per watt, because only part of the input energy can be con-



Panels no thicker than window glass, lining the walls and ceiling, provide pleasant light for experimental room at Westinghouse's modern research laboratories.

verted to ultraviolet light, and only part of this ultraviolet light can be converted to visible light.

### Color

The color of light given off by the lamp is determined by the phosphors used. Zinc sulfides, activated by combinations of copper, lead, and manganese, can produce a range of colors from deep blue, through green, to yellow and orange. By proper utilization of a mixture of phosphors, mainly blues and yellows, white light of any color temperature desired between 2500° K and 25,000° K can be readily produced.

As frequency is increased, some phosphors tend to emit shorter wavelength light — toward the blue end of the spectrum. The light actually produced consists of one or more bands in specific wavelength regions. The effect of frequency change is to alter the relative brightness of light emitted in each color band. If a cell is composed of a mixture of two different phosphors, there can be considerable variation in the characteristics each one exhibits regarding the frequency effects on its brightness. At low frequency, for example, lamp color would be dominated by the first phosphor; as frequency is increased, the color of the second phosphor would become more predominant.

To create even more distinct color variation, lamps can be made in multicell form, stacked one on the other and connected to a common, variable frequency power supply. Since the electroluminescent lamp is a capacitor, each cell can be tuned to a different frequency by using inductors connected in series with each lamp. Only small changes in frequency would be necessary to produce large color variations.

### Maintenance

Like an ordinary capacitor, an electroluminescent lamp will fail only when it is subjected to conditions beyond its rated capacity — such as high voltage surges. There are no filaments to break, no gases to become contaminated, and no emissive material to be consumed. End of life normally is determined only by decrease in lamp brightness. Momentary overvoltages, the major cause of electroluminescent lamp failure, create minute punctures of the dielectric at a thin spot, resulting in black specks appearing on the face of the lamp.

Another factor in the economics of lighting specification is lamp cost. Present electroluminescent lamps are much more expensive than comparable output fluorescent or incandescent lights. Some lamp manufacturers say this is because of the present difficulties associated with the production of extremely thin yet uniform phosphor-dielectric layers. Costs can be expected to drop, however,

as manufacturing techniques improve and production volume rises.

### Applications, Present and Proposed

Sylvania already has produced nearly ½ million small electroluminescent lamps for clock faces and instrument dials, and is stepping out from its present pilot-plant setup into full-scale commercial production. This firm has been actively working on automobile dashboard lighting, and expects to manufacture 4-million "Panellescent" units to be used in 1960 automobiles. A small oscillator converts the car's power supply to alternating current.

Westinghouse currently is marketing a small (2" x 2") "Rayescent" safety light for home use, rated at 1/200th watt. This lamp will burn continuously for a year for considerably less than a penny. Its designers rate its life at 10,000 hours, but consider it capable of producing some illumination for a much longer time.

Lamps in size up to 24" x 24" are available for commercial and special applications, rated at 120, 240, 300, 460, and 600 volts, and for frequencies from 25 cps upward. The 120-v, 60-cps lamps have brightnesses below 1 footlambert but glow clearly in darkened areas. Brightnesses are higher at higher voltages and frequencies.

The first electroluminescent lighting available to the consulting engineer as an alternative to either incandescent, mercury vapor, or fluorescent lighting, probably will require a separate high frequency power supply. But for some projects, the important space saving advantages — perhaps even reduction in building heights — and design simplicity of wafer thin lamps might more than compensate for the cost of frequency changing equipment, which is coming down in price rapidly. ▲▲

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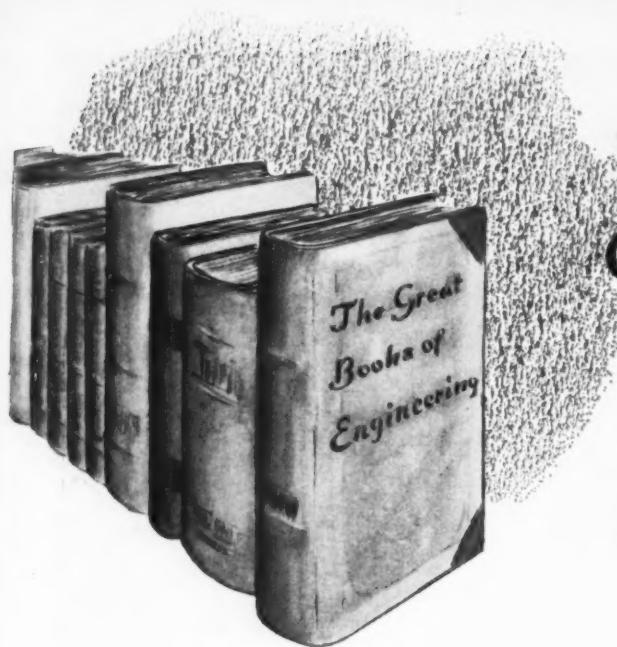
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# Hero's Treatise on Greek Technology

JAMES KIP FINCH, Dean Emeritus  
Renwick Professor of Civil Engineering  
Columbia University

**CG exclusive** HERO OF ALEXANDRIA has long held a fabulous position in the history of science and invention. He has been hailed as an outstanding mathematician and mechanician as well as a clever inventor. He first suggested many important devices and, in particular, anticipated by centuries the use of steam power. Actually the various surviving fragments of his writings are particularly revealing and valuable. They reflect and summarize the remarkable technical contributions of ancient Greece in furthering greatly the progress of the practical arts.

Hero wrote at the close of the great period of Greek leadership. Many of the various devices and techniques he describes reflect earlier practice. It is difficult to separate these from his own contributions and inventions. In fact he states, "We have thought proper to arrange in order what has been handed down by former writers, and to add thereto our own discoveries." Unfortunately, the works of many of these "former writers" have been lost but Hero's books remain to reveal Greek advances in techniques and methods that long were basic in the practical arts of construction and machine building.

Some historians assume Hero had been a pupil of Ctesibius, who was known particularly for the invention of a water organ which Hero fully describes. This would place him at least as early as 150 B.C., perhaps even earlier. Yet he seems to have been unknown to such later Roman engineers as Vitruvius and even Frontinus. He is not men-

tioned by other writers until the third or fourth century A.D. His dates thus remain uncertain. In fact, we know him only by his name, his writings, and as a citizen of Alexandria.

## Alexandria the Center of Learning

After the death of Alexander the Great in 323 B.C., the vast Near-East empire he had brought under Greek rule was divided among his generals. Egypt fell to Ptolemy who gave his name to a line of rulers which continued until the Romans took over in 45 B.C. The center of learning passed from Athens to Alexandria, and a great library was developed to which learned men and students came from all over the ancient world. A dawning natural science was seeking to explain practices and methods which had evolved through centuries of practical trial and observation.

It was in Alexandria, about 300 B.C., for example, that Euclid "arranged in order" and rationalized earlier discoveries in surveying and thus created *geo-metry*, or the theory of land measurements. Mechanics likewise originated in attempts to explain the action of the *mechane*.

Greek scholars, to be sure, regarded practical affairs as beneath the dignity of the "natural philosopher," as the natural scientist was long to be known. Plutarch tells us that Archimedes, popularly acclaimed for his mechanical and other practical accomplishments, "possessed so high a spirit, so profound a soul, and such treasures of highly scientific knowledge, that though these inventions had obtained for him renown of more than

human capacity, he yet would not deign to leave behind him any commentary or writings on such subjects."

Hero did not suffer from such inhibitions. In his works he devotes major attention to describing and illustrating various devices and methods. At the same time, he does offer some reasons for the techniques or actions involved.

Alexandria continued to flourish until destroyed by the Saracens in 640 A.D. at which time its famous library was also lost. However, many of its books were preserved in Arabic and early Greek versions, among them parts of seven attributed to Hero. These usually are described as: *On Machines of War; Mechanics, or Machines for Raising Weights; Darts and Arrows; Pneumatics and Automata; Stereotomy and Measurements; Surveying; and Geometry.*

### Surveying

Hero's books on surveying, mechanics, and pneumatics are perhaps most interesting to the engineer. His basic surveying instrument, the dioptra, was the forerunner of both the modern engineer's transit and level. Its horizontal plate with pivoted sighting arm, mounted on a short Doric column, provided a more accurate method for setting out right angles than the groma, a simpler and undoubtedly an older right-angle device described by Vitruvius. Surveying, however, was to remain "right-angle" surveying, based largely on similar triangles, until almost the 17th Century. Hero handles a number of practical problems in this way, including that

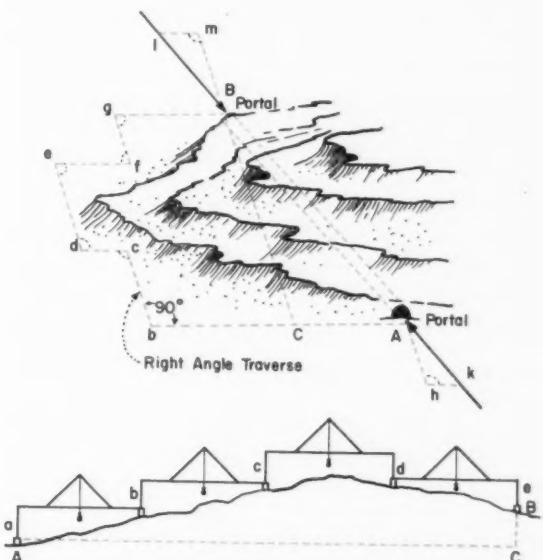
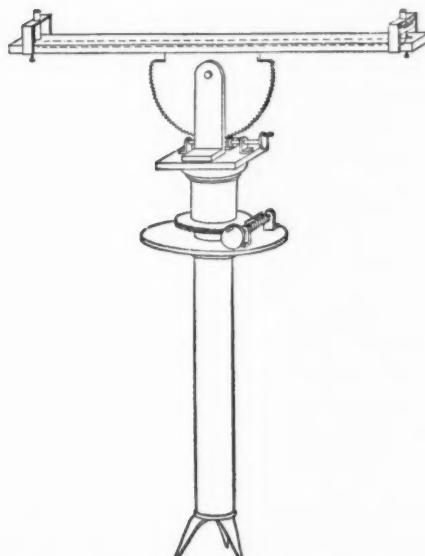


Alexandria, seat of learning until destroyed in 640 A.D.

of obtaining the distance across a stream or to an inaccessible object. Certainly one of the most interesting is that for the alignment of a tunnel to be driven from two headings, one on each side of a mountain.

When one recalls that hand-tools, plus occasional use of fire-setting (the shattering of a heated rock by sudden cooling with water), were the sole methods for making such excavations, tunnels of ancient times clearly constitute one of the major accomplishments of early engineers. The Father of History, Herodotus, had described about 450 B.C. the work of one Eupalinus of Megara, who had been called upon to excavate a tunnel some 3300-ft long for water supply on the island of Samos.

Presumably the planner and designer of this work, to whom Herodotus refers as an arkitekton or arch-technician (the first use of the title from



Left; Hero's dioptra. Right; methods of tunnel surveying he knew, with alignment survey at top and leveling below.

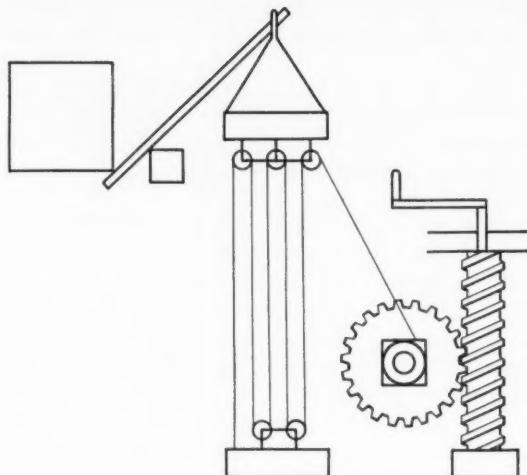
which architect is derived), may have directed the two headings and determined the tunnel length and grade by "ranging in" a line over the mountain and making direct measurements. Actually the two headings failed to meet, either in alignment or grade, but the workers apparently heard each other and joined them by a crosscut. Hero's method, by right-angle traverse, permitted the selection of the most favorable route for easy and more accurate measurement. Basically, it still is followed in tunnel surveying today. The problem of shaft planning where several intermediate and sometimes deep shafts were to be used also received attention from this ancient technical expert, and he developed a workable solution.

Leveling was basic in the construction of water supplies. Early levels had been of the plummet type, the early A-frame or a similar form. Hero describes a water-tube attachment for his dioptra, plus the use of poles with sliding targets, and the determination of a difference in level by successive plus and minus sights. Vitruvius preferred the chorobates, a plummet type. Centuries elapsed before the telescopic sight and level vial made more accurate leveling possible, but Hero thoroughly understood the basic principles involved in this aspect of surveying.

#### Flow Measurement

Perhaps the most important contribution from Hero's book on surveying is his discussion of the measurement of the flow of a spring. After describing seasonal variations in flow as due to variations in rainfall in the mountains, he states that the spring must be walled up all around and forced to flow through a rectangular pipe built in this wall. If the depth of flow is 2 digits and the width of the pipe 6, the flow, he notes, "is said to be 12 digits." He then goes on to state: "Observe always that it does not suffice to determine the section of flow, to know the quantity of water furnished by a spring . . . It is necessary to find the speed of its current, because the more rapid the flow, the more water the spring will furnish, and the slower it is, the less it will produce. For this reason, after having dug a reservoir lower than the stream, examine by means of a sundial how much water flows into it in an hour, and from that deduce the quantity of water furnished in a day. Thus one has no need to measure the section of a stream. The measure alone of the time suffices to make evident the flow of the spring."

This notable observation seems to have been passed over completely by other early workers. Roman engineers ignored velocity. Frontinus (about 100 A.D.) had difficulty reconciling cross-section measurements of flow, and it was not until



*The mechanical advantages known to Hero. In these lie the fundamentals of the machines of the ancients.*

many centuries later that the truth of Hero's statement became obvious to engineers.

#### Mechanics

Hero's work on mechanics and hoists is divided into three books or chapters. He closes the first book with the statement: "This book furnishes a first introduction to the art of mechanics. In those that follow, we speak of the five simple machines with which we raise or move heavy bodies, also of the physical reasons for their operation; we treat also of other things which are of the greatest use in the transportation or lifting of heavy weights."

Actually Book I begins with a discussion of a train of gears as a means of moving "a given weight with a given force," the ratio of the diameter of the gears being taken into account "as has been demonstrated by Archimedes."

Books II and III are of greater interest. In Book II he describes his version of the basic mechanical advantages: "The simple machines by which we move a given weight with a given force are five in number: we shall describe their forms, their methods of use and give their names. These machines are based on a single, natural principle, although they are very different in appearance. Here are the names: the capstan, the lever, the pulley, the wedge, and the screw."

The single principle turns out again to be that of the lever, of which he observes, "Perhaps this machine is itself the first which was invented for moving bodies of great weight." Hero also clearly describes the action of the multiple pulley and notes that the movement of the load is inversely

proportional to the number of pulleys. He then proceeds to raise a curious series of questions in mechanics including: "Why does a wagon of two wheels carry a load more easily than a wagon of four wheels? Why do large weights fall to the ground in less time than lighter ones?"

In his attempts to answer these questions, Hero offers little of practical value to the engineer. Even Archimedes' quantitative, mathematical demonstration of the law of the lever, a law long qualitatively known and obvious to anyone who ever used a lever, had little practical value. It was undoubtedly a major advance in mechanical theory, but little or no opportunity existed to give practical application or value to this more precise understanding until many centuries later.

Book III perhaps is best described by Hero's own note: "In this book, we describe the devices which serve to facilitate the preceding operations (i.e., of raising weights) and of moving heavy bodies. We describe also apparatus for exerting pressure, and its necessary handling to produce greater pressures." It includes illustrations of various wood frames with pulley and tackle; derricks, hoists, and capstans of ancient origin; different types of hooks and a clevis for holding stone; and a screw jack of quite modern form.

## Pneumatics

Hero's *Pneumatica* often is regarded as the most important of his works. Here one finds his suggestion for producing rotation by steam, the familiar sphere with two curved arms mounted on an axis. Of even greater importance, however, was his fire-

engine. This was a double cylinder, hand operated water pump — a design still in wide use at the turn of the century by fire fighters. Pliny pleaded in Roman times that the Emperor Trajan send such a fire-engine to a town in Asia Minor, and volunteer fire companies pulled similar engines to city conflagrations before the advent of the steam fire-engine of the 19th Century.

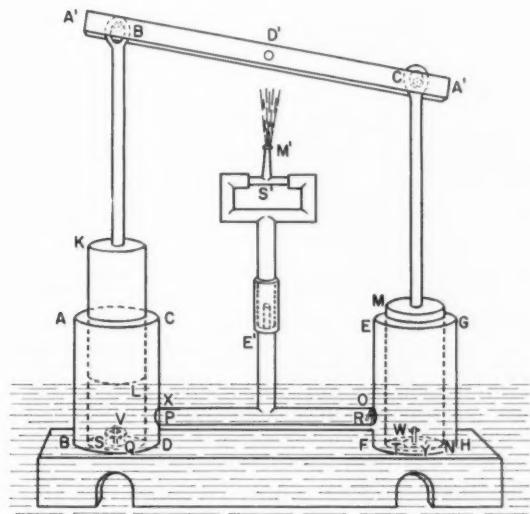
Hero describes the construction of his pump (see drawing) as follows: "Take two vessels of bronze, ABCD, EFGH, having the inner surface bored in a lathe to fit a piston, KL and MN, being the pistons fitted to the boxes. Let the cylinders communicate with each other by means of the tube XODF, and be provided with valves, P, R, . . . within the tube XODF and opening outwards upon the cylinders. In the bases of the cylinders pierce circular apertures, S, T, covered with polished hemispherical caps, VQ, WY, through which insert spindles soldered to, or in some way connected with the bases of the cylinders and provided with shoulders at the extremities that the caps may not be forced off the spindles . . . Now, if the cylinders, provided with these additions, be plunged into a vessel containing water, and the beam A'A' be made to work at its extremities which move alternately about the pin D', the pistons, as they descend, will draw out the water through the tube E'S' and the rotating mouth M'."

This volume also contains some interesting observations on air and water pressure and, of course, includes the many descriptions of *automata* for which Hero is famous. These very all the way from a means of causing the door of a temple to open automatically, to a wine jar that never can be emptied. Presumably many of them were used by early priests in Egypt to hoodwink the public.

## Lasting Impact

Hero's works constitute a complete and effective encyclopedia of Greek technology. The Roman *architectus* may have secured his inheritance of Greek engineering by direct importation of Greek talent or from other authors, but he added little.

As early as 1547 the book on pneumatics was translated and published in Italy, and there are other early Latin editions of some of Hero's work. Greenwood and Woodcroft did an English translation in 1851 (London: Taylor, Walton, and Maberly), and a French-Arabic version\* of the books on mechanics was published in Paris in 1894. Teubner in Leipzig began issuing a modern edition of Hero's works, in German, with originals in either Arabic or Greek, in 1899, but, as far as we know, there is no complete translation in English now in print. ▲▲



*The force pump as described by Hero and as used by fire fighters until the advent of the steam fire-engine.*

\**Les Mec'aniques ou l'E'l'e-vateur de He'ron d'Alexandria* in Arabic and French, by Carra de Vaux. Paris. 1894.

# Get the Graduate



CHESTER W. LYON, Personnel Manager  
Howard, Needles, Tammen, & Bergendoff



*Chester W. Lyon attended the University of Kansas City, receiving his degree in 1940 and later doing additional graduate work. Following a period of military service, he was employed for 12 years by the United States Department of Labor, first as an investigator and later as regional analyst in the Wage and Hour and Public Contracts Divisions. Lyon joined Howard, Needles, Tammen & Bergendoff in 1954 as personnel manager. He is a member of the Kansas City Personnel Research Forum.*

THE FIELD of personnel management presents challenges that are not inherent in the exact sciences, for all of its problems involve the greatest of variables — human nature. In the consulting engineering field these problems are particularly significant, since in great part they concern the basic attitudes, desires, and need for professional recognition. It would be difficult to follow the pages of any professional engineering publication without realizing that a constant crusade is being waged, not only by the embryonic engineer, but by the veteran to obtain increasing recognition for his profession and his own professional status. This professional aspect of engineering is important, we find, even when hiring young engineering graduates.

Our firm employs several hundred engineers who are engaged in the design and supervision of con-

# That Fits the Firm



struction of bridges, expressways, and highways. A great deal of our work involves phases of civil engineering that are above the level of the college textbook. We are constantly in search of new methods and new approaches to problems. We are, for example, active in the field of photogrammetric engineering as it applies to our operations and are striving to make more efficient use of new methods of electronic computation, both in design problems and in the field of traffic analysis.

For these reasons, we are basically a firm of young engineers. We are always looking for talent and have made extensive efforts in the field of college recruiting. We have hired many young graduates and have studied their contribution to our overall program. We now know that the most important factor to be considered in selecting a new engineer is his interest in our field, combined with an ab-

stract characteristic that involves potential leadership and professional bearing.

## Three Basic Classifications

In the past five years I have talked with many hundreds of young men who were soon to receive their Baccalaureate degrees in Civil Engineering. These men can be divided into three classes.

First, there is the young engineer who comes to the interview room with the obvious attitude that he is his particular college's "gift to the world." He talks with all interviewers who present themselves on the campus. He is a particularly easy man to interview because the interviewer does not have to say anything. He simply answers the young man's questions concerning the rapidity of advancement, the multiplicity of fringe benefits, and the minimum time that would be required for him to become a principal or a partner in the firm.

The second type of young man is genuinely interested in the profession of engineering, but he feels that in view of his "extensive training" he should start out as a designer of long span bridges or complex interchanges. He informs the interviewer that he is a poor draftsman, and because of his particular background, there is no question but that his abilities should be used in straight design.

The third type represents the man for whom we endlessly search. This young man is, of course, interested in advancement and professional recognition. He differs from the other two types, however, in that he realizes that he has completed only his basic training, and it is necessary for him to learn by actual experience before he can become an expert in his field. He realizes that it is basic in the engineering field that he must convey his thoughts through the media of drawings so that they are intelligible to his fellow workers, his supervisors, and our clients. He knows where his interests lie. A young man possessing these qualities and having an interest in our field need not worry about advancement. With the ever increasing work load in our field of civil engineering, he cannot help gaining status both professionally and financially.

## Scholastic Record Only One Factor

I have been asked many times by colleges and placement officials whether or not we placed particular emphasis on a man's scholastic achievements. In recent months, we have received numerous ques-

tionnaires from colleges on this subject. I believe that usually a student with an above average scholastic record turns into an above average man. But I am not convinced that the man who has a top scholastic rating in his class will necessarily be a top man in his group when he is employed.

Many of the young men I have interviewed have been at the top of their class scholastically, yet in some instances I knew these young graduates would be wholly unsuited to our particular field. There are many qualities of leadership and ability to work with other men that are quite significant in a man's engineering career, and these important characteristics are not always apparent in a study of a scholastic record.

It has been my observation that the true leaders in the field of civil engineering have been men who possess special qualities of personality and leadership different from those of the average engineer. Assuming a sound engineering background, the ability to adequately and efficiently present ideas is basic in achieving recognition. To put it another way, most of our finest engineers, certainly those in private practice, are men who can tell others what they know and can get them to act.

When we choose a physician to care for our families, I doubt that any of us have investigated or even shown interest in the doctor's average grade in pharmacology. Yet, we let him prescribe drugs which would mean death if he prescribed improperly. Instead we base our selection of a physician primarily upon his local reputation or his personality.

When we seek the services of an attorney, we are not particularly interested in the attorney's grade in law school. We are interested in the record he has made in handling cases of the type we have for him, or we may simply have met the attorney and were impressed by his personality and bearing.

I do not mean to imply that scholastic achievement is unimportant. A good educational background is irreplaceable as a basis on which to build a sound engineering career. Few men can succeed without it. I simply want to emphasize that there are other factors that are of equal or greater importance in achieving success and professional recognition in engineering.

#### Attitude Important

The professional potential of an employee or an applicant has a direct bearing upon personnel administration in a consulting engineering firm. The very factors that motivate a man to choose a profession rather than a trade affect the company-employee relationship.

Much has been written recently in professional journals about the comparative wages of skilled workmen and engineering personnel. It is obvious

that before a man can practice engineering, or law, or medicine, he must invest thousands of dollars in his education. In addition, he must spend countless hours in intense study. If the criteria for choosing a professional career involved only the remuneration that the man would receive in his early working years, there would be very few professional men. It is the desire to achieve professional recognition, coupled with a genuine interest in a field, that supplies the impetus for a choice of a professional career.

Therefore, employer-employee relationships in a professional organization are of a different order from those found in a factory. For example, the use of time clocks is prohibited throughout our organization. Records of man-hours are maintained for cost purposes and for the purpose of satisfying legal requirements, but we do not expect a man to punch a clock. To do that would discourage rather than encourage an attitude of professionalism.

#### Professional Development

Our employees are encouraged to obtain professional registration. They are encouraged to study and become more proficient in associated fields. In line with this policy, we have established an extensive library within our firm for the use of our personnel. We encourage membership in professional societies and the writing of papers and articles on engineering subjects. We welcome suggestions on more efficient methods of handling our work.

When a young man has received sufficient background to enable him to deal effectively with clients, he is encouraged to participate in meetings and presentations. Employees attend conferences and meetings, many of them at the firm's expense, where additional knowledge can be gained in engineering fields. We believe that all of these factors are important in the professional development of engineering personnel. Our policy, we feel, benefits our engineers and our firm.

Ours is a professional firm made up of the combined talents and characteristics of the individual engineers who work together here. Therefore, we feel that it is important that in hiring we select men of potential professional caliber. These are the men who eventually will receive the degree of professional recognition they strive to attain. These are the men who will most appreciate and make use of the professional atmosphere our firm provides.

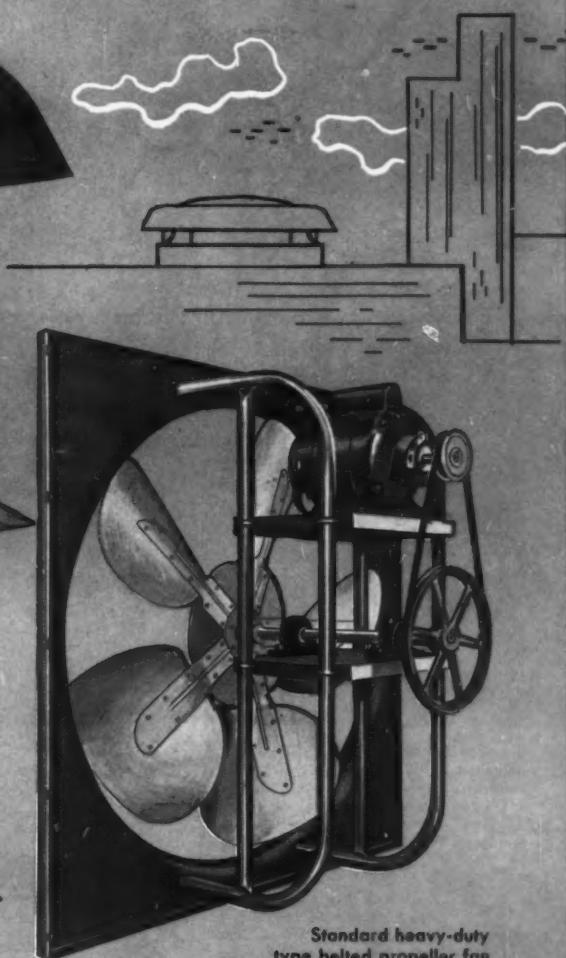
I believe that the colleges must make certain that their students understand the application of their college courses to practical engineering problems. It then is incumbent upon the young engineer and the firm for which he works, to strive together toward a goal of outstanding professional achievement.

**VP-EX PROPELLER-TYPE**

# belted roof ventilator



Self-contained VP-Ex  
belted roof ventilator



Standard heavy-duty  
type belted propeller fan

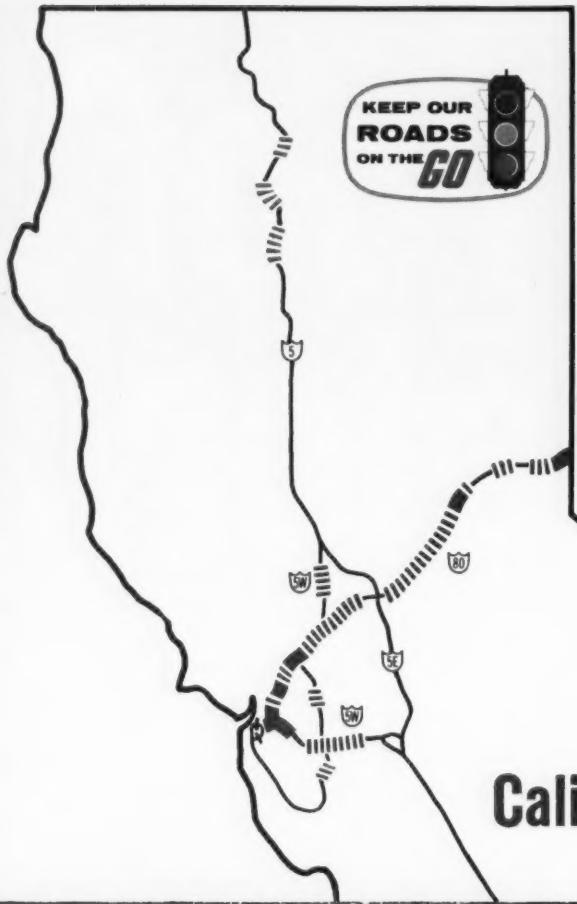
The outstanding performance of the VP-Ex Belted Roof Ventilator is derived from insistence on quality at every step—from its galvanized construction through its complete industrial-type propeller fan. This large-capacity workhorse keeps overall height at a minimum while providing efficient operation and proper clearance between air discharge and roof. Capacities from 4450 CFM to 33900 CFM; also available in smaller direct drive sizes.

Send for Bulletin 582.

**nyb**

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Steel Bridges over the Truckee—Structural Steel bridges carry Interstate Route 80—(U.S. 40) over the Truckee River in the Tahoe area. Over 17,000 tons of structural steel a year help make California's highways among the best in the nation.

## California speeds construction



Drainage for Interstate 80—(U.S. 40) USS Galvanized Culvert Sheets and sectional plate structures solve drainage problems under the Interstate Highway at Truckee, California. Here steel provided low-cost, rapid construction.



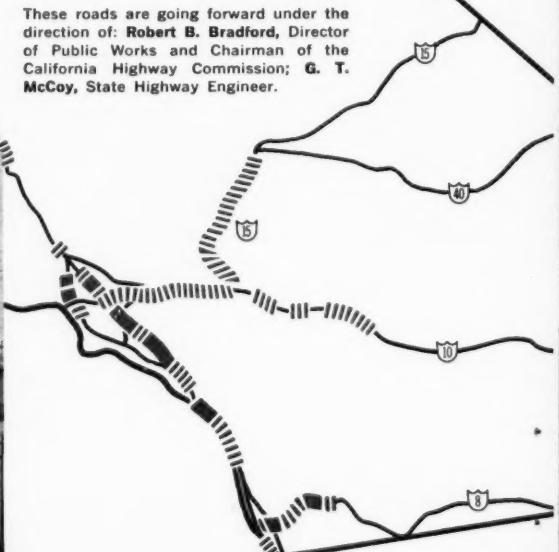
Steel signs, posts, and guardrail—Available from U. S. Steel are most of the basic products that produce long-lasting, low-maintenance signs and markers; uniformly coated galvanized steel sheets, steel plates and tubular sections for hot-dip galvanized posts, poles, and supports; USS Vitrenamel Sheets for porcelain enameled signs. Also shown here is USS Western Guardrail on the San Bernardino Freeway, Los Angeles.

— Completed

||||| Partially completed or under construction.

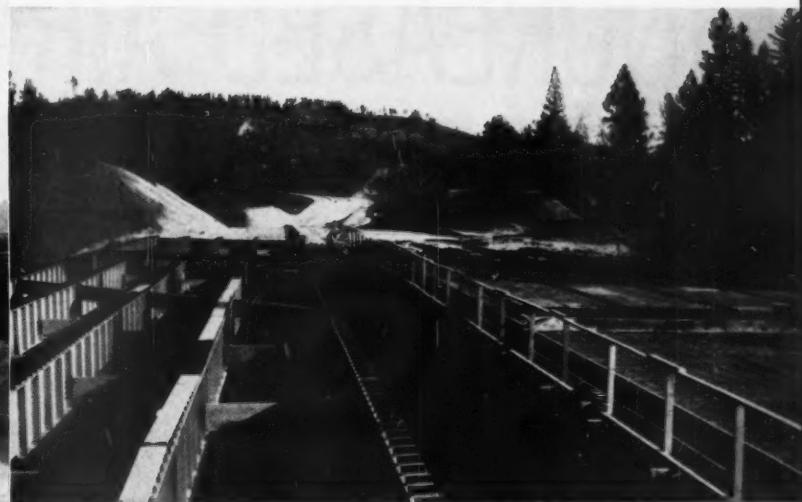
— Present highway to be made into Interstate.

These roads are going forward under the direction of: Robert B. Bradford, Director of Public Works and Chairman of the California Highway Commission; G. T. McCoy, State Highway Engineer.





**Overpass at Albany**—Steel girders will be placed on top of these steel-reinforced concrete columns to form an overpass at Albany, California. USS *Di-Lok* Concrete Reinforcing Bars are used for all types of concrete work; and Universal Atlas Cement Division of United States Steel, offers a wide variety of portland cements. *Tiger Brand* Wire Rope is used in cranes, pavers, shovels, ditchers, trenchers, derricks, mixers and road scrapers.



**Steel Bridges at Magra**—The USS *Di-Lok* Bars in the right-hand side of these bridges at Magra near Gold Run, California, are ready for concrete. The next step in the construction of the left-hand bridge is to place the decking on top of the continuous girder span.

## of 2,194 miles of Interstate Highways

**with products from United States Steel**

CALIFORNIA'S HIGHWAY COMMISSION has planned 2,194 miles of Interstate Highways to be completed by 1975. 1,453 miles have already been located; 73 miles have been completed, and 170 miles are under construction. Several hundred miles of California's own Freeways are near to meeting the rigid requirements for the Interstate System; when they do, the number of *completed* miles will rise rapidly.

Steel is high on the list of products being used to speed construction on the eighteen highways in California's Interstate System: 3,186 bridges, overpasses, underpasses, and traffic-controlling clover-leafs will be built; 123 bridges are already completed and 194 are now under construction.

United States Steel supplies a complete line of products for highway construction: Structural carbon steel and special high-strength and constructional alloy steels for bridges; steel H-piles, sheet piling and tubular piles for bridge foundations; drainage products; reinforcing bars, welded wire fabric, cements, slag and other pavement construction

products; wire rope, cable, tubing and special steels, and steel products for construction equipment; and a complete range of items including fence, beam and cable guardrail, steel for signs, markers, and other accessories. Write for the *free* 54-page booklet, "Keep Our Roads on the Go." This booklet lists all the products and services available from United States Steel to help you cut costs and speed operations in every phase of highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

*USS* and trademarks in *italics* are registered by U. S. Steel



**United States Steel**

**The highway market is served by the following divisions of United States Steel:** American Bridge Division, Pittsburgh, Pa. • American Steel & Wire Division and Cyclone Fence Department, Cleveland, Ohio • Columbia-Geneva Steel Division, San Francisco, Calif. • Consolidated Western Steel Division, Los Angeles, Calif. • National Tube Division, Pittsburgh, Pa. • Tennessee Coal & Iron Division, Fairfield, Alabama • Universal Atlas Cement Division, New York • United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.

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Available now in 44 belt drive models  
plus 17 direct drive units together providing capacities from  
180 to 13,500 C.F.M.

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Fiber-Aire's all Fiberglas housing actually absorbs noise and vibration . . . sets a new standard for ventilator quietness.

### Adjustable Capacity

Belt drive units feature easily adjustable sheaves . . . capacities are quickly changed, even after installation.

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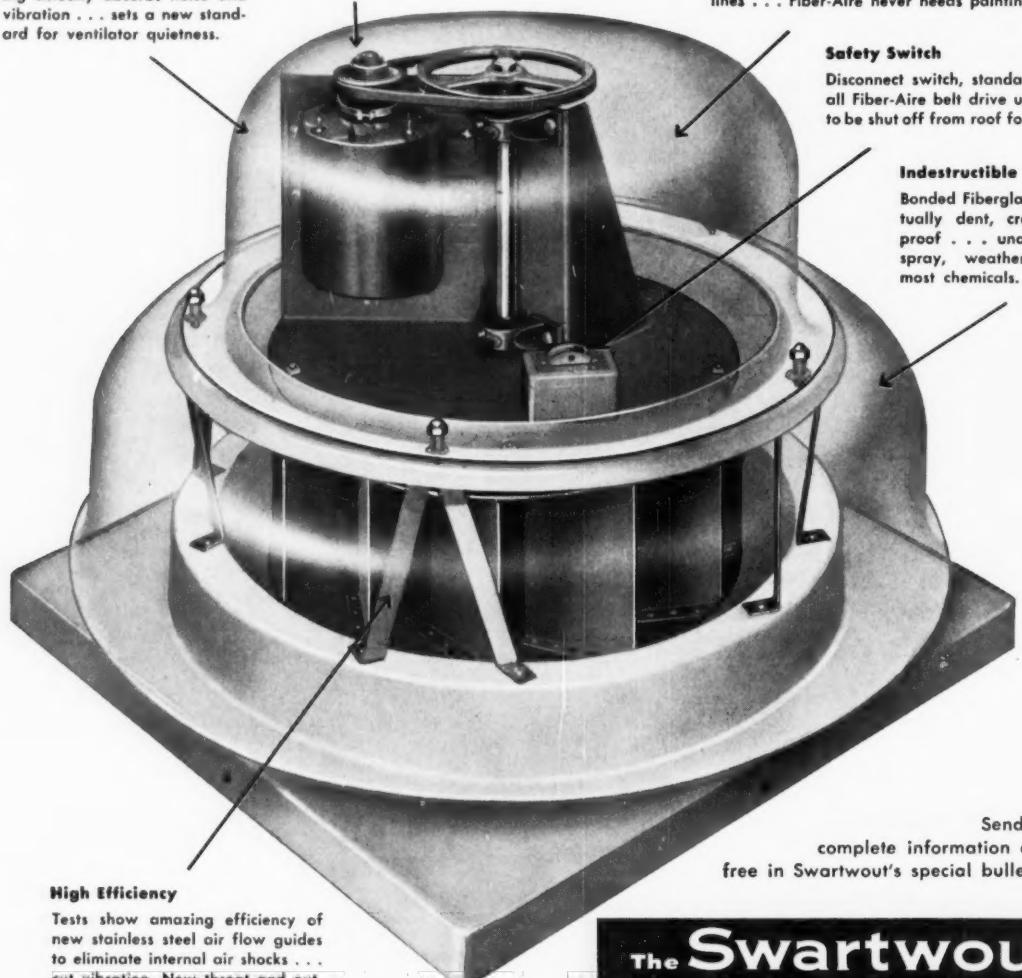
Extra low contour and molded-in sky blue color, that "disappear" against the horizon, never mar clean architectural lines . . . Fiber-Aire never needs painting.

### Safety Switch

Disconnect switch, standard equipment on all Fiber-Aire belt drive units, permits unit to be shut off from roof for absolute safety.

### Indestructible

Bonded Fiberglas housing is virtually dent, crack and break proof . . . unaffected by salt spray, weather, fumes, and most chemicals.



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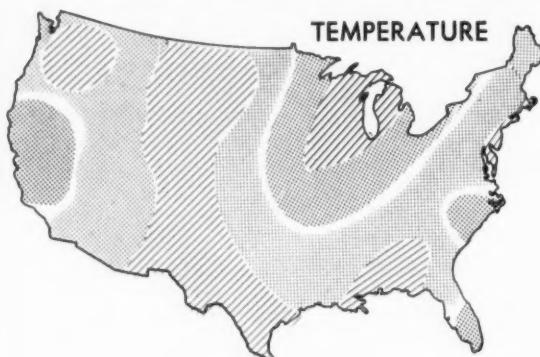
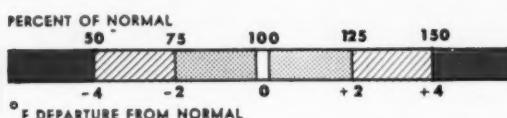
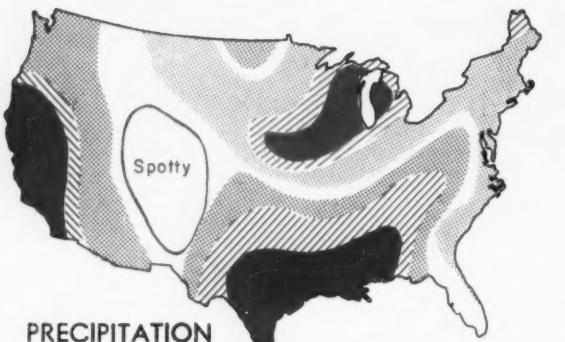
In Canada: Eastern Steel Products Ltd. 8 Bermondsey Road, Toronto, Ontario



# KRICK WEATHER OUTLOOK

JULY 1959

Prepared Exclusively for CONSULTING ENGINEER

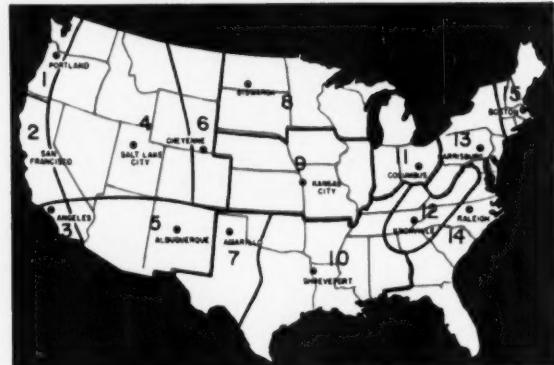


## JULY HIGHLIGHTS

During July, near seasonal construction weather is expected over much of the United States. One exception is the area extending from the Great Lakes region southwestward to eastern Nebraska, eastern Kansas, and northern Missouri, since much above normal moisture is contemplated over many sections of this region. Construction also could be hampered slightly in some valleys of Utah, Colorado, and New Mexico, where frequent threatening showers could bring above normal moisture to some isolated localities. Predominantly drier than normal weather should continue over the southwestern regions of the country. Arid conditions are expected throughout California, with some locations likely to receive less than one-half the normal seasonal rainfall. Since rainfall totals over California normally are less than 0.1" during July, many regions will not receive any measurable moisture. The southeastern regions of the country also will be much drier this July, with the immediate Gulf coastal areas receiving less than one-half the normal seasonal totals. This, coupled with warmer than normal temperatures, should provide favorable construction weather for the lower south. Although slightly cooler than normal average temperatures are anticipated in the Great Lakes region, there should not be any unusually cold readings. The cooler than usual readings should be the result of frequent cloudiness and scattered intermittent shower activity, which should tend to lower the daytime high temperature readings. Elsewhere over the nation, near to slightly warmer than normal average temperatures are expected to prevail.



TEAR OUT ALONG PERFORATION.



## CONSTRUCTION DAY CRITERIA

To be considered a construction day on these charts, the day's maximum temperature must be more than 38 degrees. There must be less than six inches of snow on the ground. There must be less than six hours of active precipitation during the period between the hours of 7 a.m. and 5 p.m. There also cannot have been more than one inch of rainfall on the preceding day.

CONSULTING ENGINEER

These forecasts are prepared by Irving P. Krick Associates, Inc., the world's oldest and largest weather engineering firm. The forecasts are based on methods developed by this group at California Institute of Technology prior to World War II. After the War, the methods were adapted to high speed electronic computing machines to shorten the time required to solve the complex problems of the atmosphere. Ultra-long range forecasts, up to a year or more in advance, are now available. Information on other Krick weather services is available by writing to the home office of the firm at 460 South Broadway, Denver, Colorado.

## CONSTRUCTION DAYS

LOCATIONS	JULY 1959 ESTIMATES														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	31	31	31	31	31	31	31	31	31	31	31	30	30	31	30
LOWEST	30	29	31	30	29	27	29	28	23	28	26	26	21	24	26
AVERAGE	30	31	31	30	31	29	30	30	28	30	29	28	28	28	29
ESTIMATE	30	31	31	30	29	28	31	30	27	28	28	29	30	28	28

These estimated construction days for key cities in the United States should be interpreted as an average of estimated conditions over the forecast area. To obtain the best results, the forecast number of construction days should be compared with the temperature and precipitation anomaly maps and the timing estimates to determine the probable number of construction days in your locality. The forecast construction days are based on average construction day requirements as defined under "Construction Day Criteria," and should be adjusted for individual operations.

LOCATIONS	AUGUST AVERAGE AND RANGE*														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	31	31	31	31	31	31	31	31	31	31	30	31	30	31	31
LOWEST	28	29	29	28	30	27	27	26	24	26	28	27	26	25	20
AVERAGE	30	31	31	30	31	30	30	29	28	30	29	30	29	28	27

LOCATIONS	SEPTEMBER AVERAGE AND RANGE*														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
HIGHEST	29	30	30	30	30	30	30	30	30	30	30	30	30	30	30
LOWEST	26	30	28	28	28	25	25	25	24	26	28	25	22	24	27
AVERAGE	27	30	30	29	30	29	28	29	28	29	29	28	26	27	29

\*Historical Average, Not a Forecast

# JULY 1959 TIMING OF

WASHINGTON OREGON	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Slightly warmer and drier than normal is the outlook for the Pacific Northwest during July. Shower activity will be most prevalent between the 6th and the 16th. A relatively extensive period of "Indian Summer" weather is expected the last 10 or 11 days of the month.

IDAHO - MONTANA WYOMING	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Generally, rainfall totals should range from near to slightly below normal. The heavier amounts, as compared to normal, are likely in northern and eastern portions. Showers indicated around the 25th are expected to occur mainly in southern Idaho and southern Wyoming.

CALIFORNIA NEVADA	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

A much drier than normal month is contemplated over much of this area during July. Indicated shower periods will concentrate mainly in the northern mountain areas and Nevada. Principally cloudy, threatening weather should result from these widely scattered showers.

ARIZONA - UTAH COLORADO NEW MEXICO	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Look for near to above normal rainfall resulting from the concentration of frequent shower activity in some isolated localities. Generally, no moisture is expected in Arizona desert areas. The showers following the 5th are likely to be more intense in eastern portions.

MINNESOTA N. & S. DAKOTA	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Near to slightly above normal moisture is the outlook over this three-state area during July. The 5th-8th and 16th-19th intervals shown on the timing bar should bring important storminess. During other indicated periods, precipitation will come as widely scattered showers.

NEBRASKA KANSAS IOWA - MISSOURI	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Relatively hot, humid weather is anticipated during the 5th-8th and 14th-18th indicated warm periods. Generally, rainfall totals will average above normal. The heaviest amounts of precipitation compared to normal are contemplated in central and eastern portions of the area.

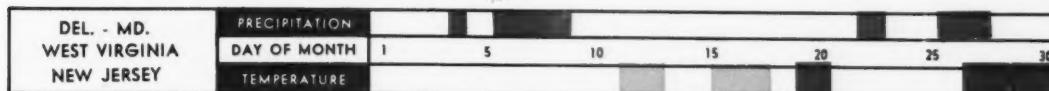
WISCONSIN MICHIGAN-INDIANA ILLINOIS - OHIO	PRECIPITATION							
	DAY OF MONTH	1	5	10	15	20	25	30
	TEMPERATURE							

Frequent storminess is expected to bring much above normal rainfall over the Great Lakes region. The storminess following the 5th should concentrate mainly in southern portions. The mid-month storminess should be heavier in the northern one-half of the area.

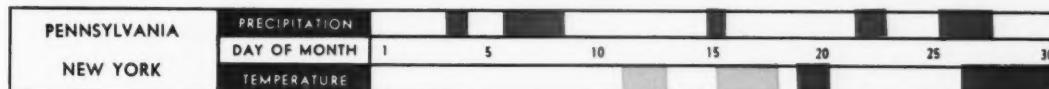
# SIGNIFICANT WEATHER EVENTS

RAIN	
SNOW	
WARM	
COLD	

The timing bars below are intended to indicate periods of important general storminess and important departure from temperature normals in areas indicated. They are highly accurate over the area indicated, but are too general to pinpoint small local storminess or showers. Allow one day on either side of indicated storm or extreme temperature periods for general planning. Combination rain or snow shading indicates either one or both.



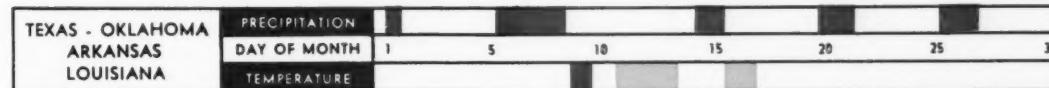
Generally, this area should have near normal weather during July. The warmer temperatures and heavier precipitation in comparison to normal apply to coastal areas. The showers indicated following the 5th should be confined mainly to southern portions of the area.



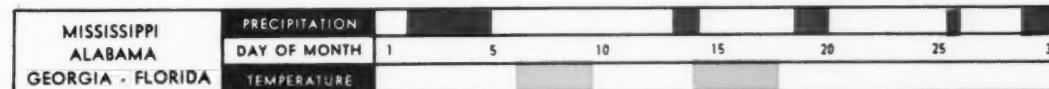
A slight cooling trend can be anticipated during the last 10 days of the month, as two intervals of relatively cool weather move through the area. The showers indicated for a day or two around the 15th of the month are expected to concentrate mainly in northern sections.



Slightly warmer than normal temperatures is the outlook over the coastal areas of New England during July, with near normal average readings at most inland locations. Two intervals of relatively important precipitation are on tap during the last 10 days of the month.



The 6th-9th, 14th-16th, and 20th-22nd shower periods apply mainly to northern sections; Gulf coastal areas will receive less than one-half the normal rainfall. Generally, the temperature outlook is near normal average readings in the east, slightly warmer in western sectors.



A drier than normal month is expected over much of the lower south during July. Only the eastern coastal areas are likely to receive near seasonal rainfall. The showers indicated around the 2nd-6th of the month should concentrate mainly along the Atlantic seaboard.



Look for the area east of the Appalachians to receive the most benefit from the showers indicated near the 4th, and the storminess centered around the 25th. The stormy interval indicated on the timing bar around the 7th or 8th will occur principally in the coastal areas.



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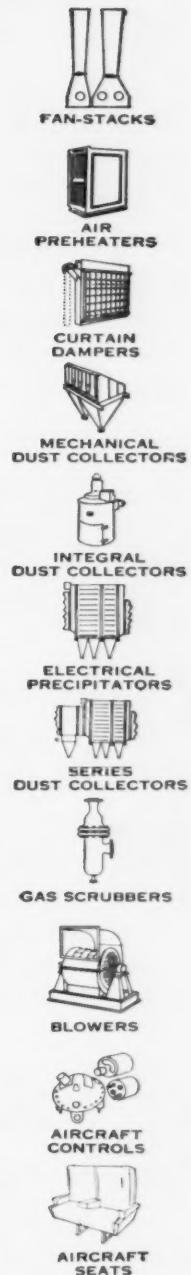
The **Industrial Division** engineers, manufactures and sells electrical precipitators and mechanical dust collectors for flyash and industrial applications, as well as air preheaters, curtain dampers, blowers and fan-stacks. Its facilities include a plant in Greenwich, Conn., and the Prat-Daniel plant in South Norwalk, Conn.

The **Aircraft Equipment Division**, Greenwich, Conn., designs, produces and sells a wide range of controls for aircraft, missiles and nuclear applications.

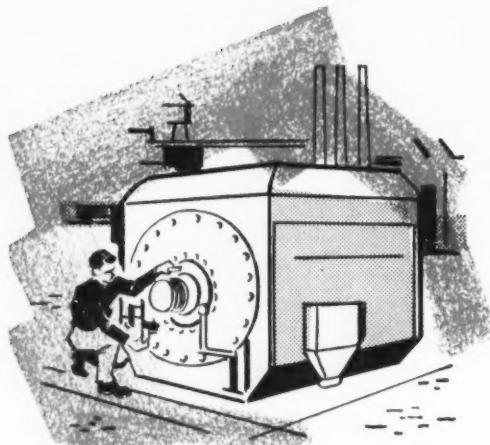
The **Aerotherm Division**, Bantam, Conn., develops, fabricates and sells aircraft seating and accessories.

An expanded and intensified program is now underway to accelerate research, new developments and technical advances that will benefit you. If you have any problems or requirements in the above fields our engineers are ready to help solve them.

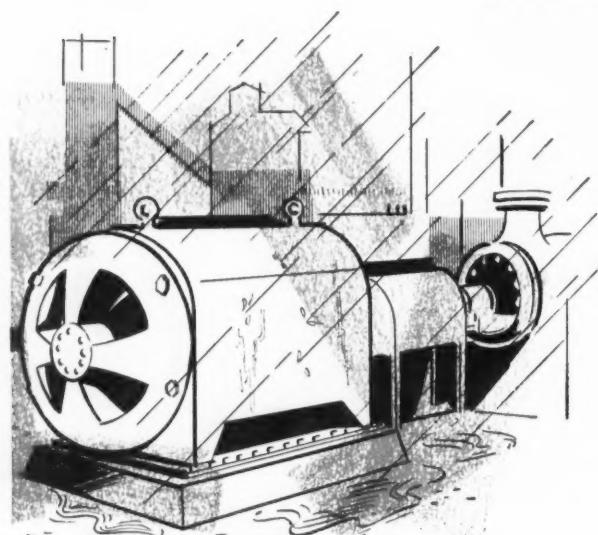
Write Aerotec Industries, Inc., Dept.-E, Greenwich, Conn.



NO NEED TO SHELTER  
MOTORS IN BUILDINGS ...

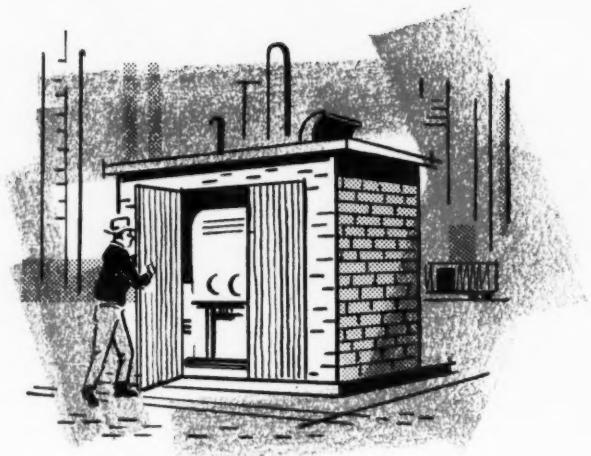


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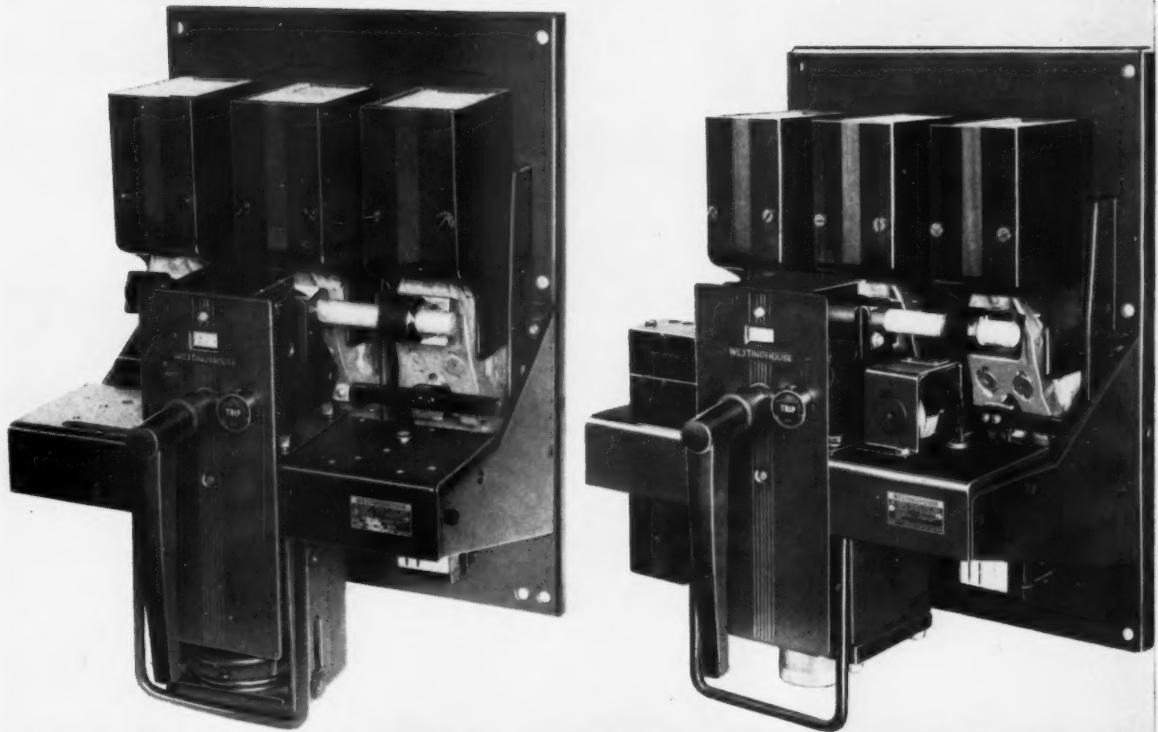
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**2**      spring-manual closing

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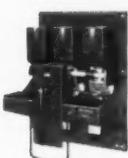
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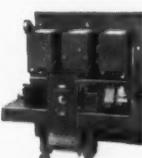
Type DB-15



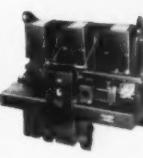
Type DB-25



Type DB-50



Type DB-75



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**You select...  
the type of  
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you want**

Conventional  
Manual Closing

For Fixed Position Mtg.      For 3-PoS. Drawout Mtg.



Quick-Make  
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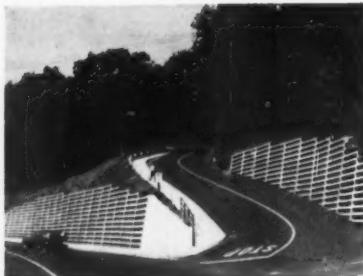
For Fixed Position Mtg.      For 3-PoS. Drawout Mtg.



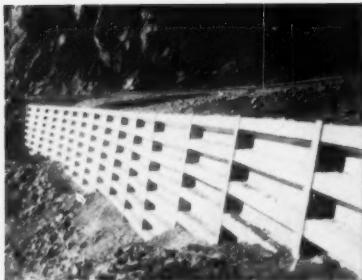
Electric Solenoid  
Closing

For Fixed Position Mtg.      For 3-PoS. Drawout Mtg.





Approach Highways?



Stabilize Slope?



Stream Erosion?



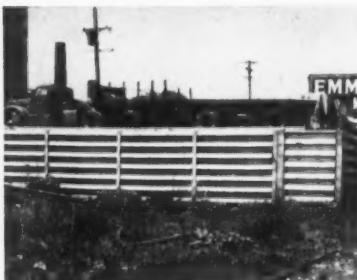
Replacing Existing Wall?



Holding Back Slope?



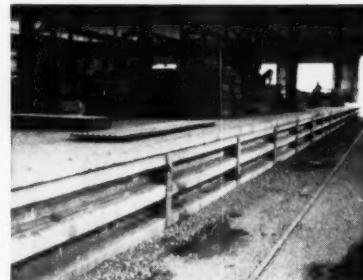
Bridge Wing Walls?



Gain Parking Area?



Elevated Railroad?



Loading Dock?

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### Can Help Solve So Many Engineering Problems

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For complete engineering details, write us for our new Retaining Wall Catalog. Armco Drainage & Metal Products, Inc., 6699 Curtis Street, Middletown, Ohio. In Canada: Guelph, Ontario.

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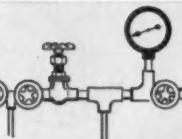
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*...at no extra cost!*

Each and every valve is tested with 90 lbs. of air ... under water.



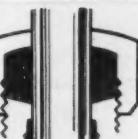
All brass parts are 85-5-5-5% red brass, the most corrosion-resistant brass alloy known.

Stem is full  $\frac{3}{8}$ " in diameter ... equal in strength to specification valves.



Handwheel screw is stainless steel for easy removal.

Packing chamber is big for positive sealing, long wear in constant use.



19 splines, instead of milled 4-point square, provide full holding power around complete circumference of stem.

Precision machining eliminates need for bonnet gasket ... a feature found only on pressure-rated valves.



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Buna-N, the most versatile disc known, is impervious to oil, gas or water. Provides more shut-offs per dollar.



Double lead threads open valve in  $1\frac{1}{4}$  turns ...  $60^\circ$  stub thread adds strength, longer useful life.

Full flow design, original with NIBCO, delivers complete capacity of piping.



Stainless steel screw retains disc securely, yet removes easily because it is corrosive resistant.

Insist upon NIBCO compact pattern valves—most versatile and thriftiest for water, oil or gas.



A valve for every application ... and bonnets and stems are interchangeable.

**NIBCO**



New valve catalog is available from Nibco wholesalers — or write

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# Field Notes

MARJORIE ODEN, Eastern Editor

## AMA Executive Action Course

GETTING ALONG with people is the basis of the financial and professional success of all executives. There is a growing awareness of this. Hundreds of men, including consulting engineers, spent up to \$850 each for the American Management Association's three-part (one week each — usually about 10 weeks apart) Executive Action Course, "designed to increase skill in the techniques of getting things done through people."

The next course begins on July 21, at Colgate University. CONSULTANT ENGINEER went to the instructor, H. B. Schmidhauser, for a preview. Among the subjects to be covered are "How to sell ideas to a client" and "How to manage and select a staff for maximum harmony and results" — important considerations for consultants.

### "Role Playing"

Role playing is one highly recommended method for selling a service to an antagonistic group. Schmidhauser told of a transportation consultant who had devised a way for a shipping company to save 1800 man-hours per year. The board of the shipping company was convinced that it had done well with the present methods.

The consultant, in making his presentation, sold the board members on role playing. Each took the role of the consultant, telling the consultant (who objected violently) why he should buy the service. According to Schmidhauser, the board sold itself. And instead of

saving the predicted 1800 man-hours, the plan was perfected to save 2400 man-hours per year.

What if the clients do not want to play games? Schmidhauser maintains that, if approached right, most of them will cooperate in role playing.

### Visual Presentations

If the client does insist on conducting the interview in a more formal manner, stress should be put on visual presentation. The consultant should go to the interview armed with charts, maps, booklets, and other attractively laid out materials.

One way most salesmen, and many engineers, fail is by selling their personality rather than their service or product. The visual material keeps the client's attention where it should be—on the project—and keeps the engineer where he should be in relation to the project—in the background.

Does the consulting engineer do best making a presentation alone or should he take along some of his top men? Schmidhauser said that if the consultant's assistants have something to contribute besides statistics and slide rule analyses (which could be a part of the visual presentation), by all means take them along. But be sure the appearance and conduct of the assistants blend with the group.

### Delicate Areas

What about hard sell vs. soft sell? "These are the two ends of the

keyboard, and the success of any presentation depends on how well the engineer can combine the two," Schmidhauser said.

Another pointer — confine business to business hours when possible. "A man is on soft ground if his selling depends on heavy entertainment. Of course, if the client suggests a game of golf or cocktails, there is no reason to refuse. Just leave it to the client."

Giving the appearance of "knowing it all" also is dangerous for it may antagonize the client. "The executive who demonstrates a realistic awareness of his own limitations will gain a better reputation for good judgment than one who reveals his limitations by refusing to acknowledge them," Schmidhauser pointed out.

### "Feed-Back"

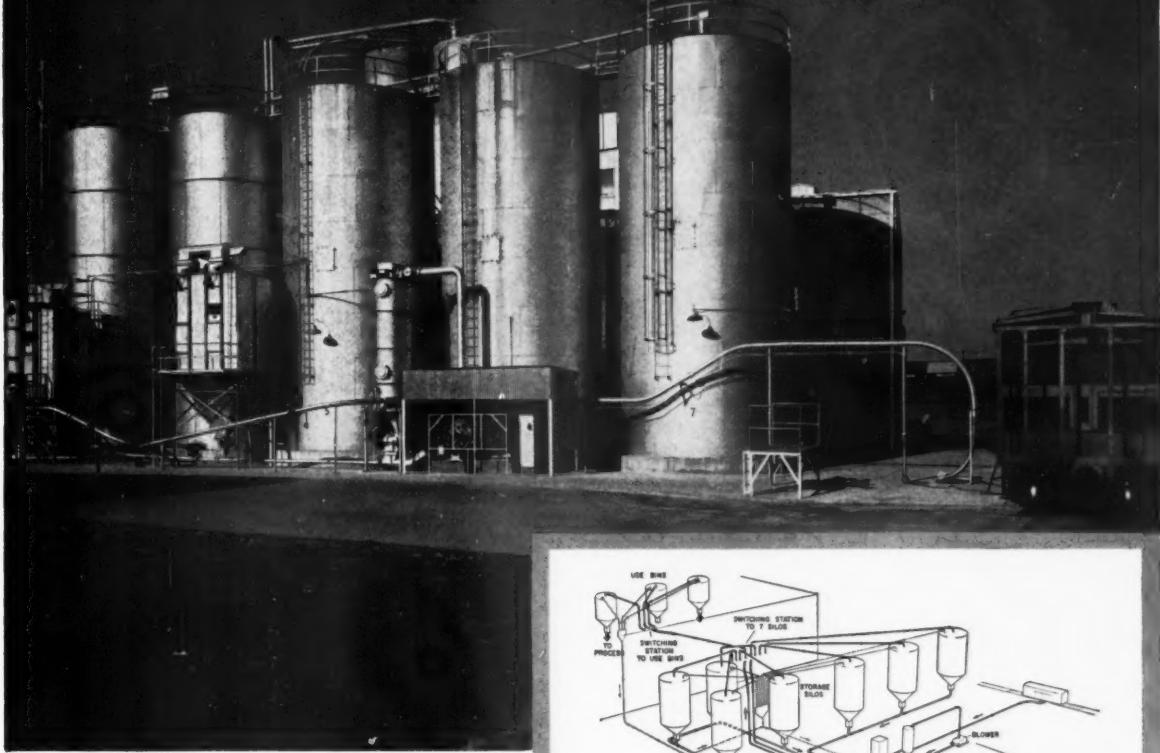
The instructor also has a suggestion for keeping the client contented — constant feed-back. "Instead of spending 15 days compiling a report after a project is completed, use the principle of constant feedback. Send frequent interim reports. Better yet, deliver the reports at the client's office in person."

"This makes the client feel more a part of his project. Furthermore, it results in the engineer and the client becoming better acquainted during the course of the project, and frequently turns a short-range project into a long-term relationship with future projects resulting."

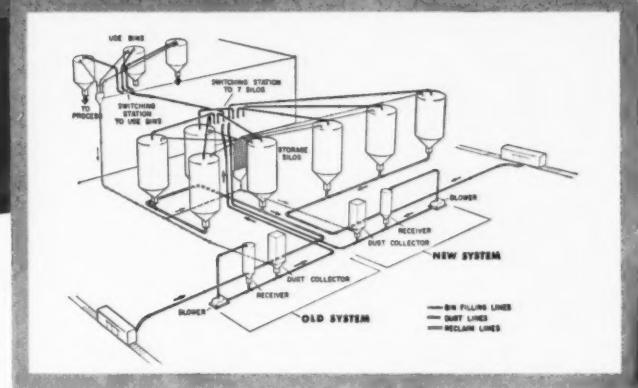
Along this same line, Schmidhauser suggests putting only what



Ease of expanding Airstream Conveyor facilities is demonstrated at St. Louis feed supplement plant of Merck & Co., Inc. Old and new systems were integrated to form smooth bulk handling unit which meets increased requirements for moving raw materials from transport through storage to process.



## AIRSTREAM CONVEYORS ARE . . .



# e a s i l y   e x p a n s i b l e

If you plan to grow, here's a thrifty way to avoid future bulk handling problems: install a Dracco Airstream Conveyor System to meet *current* needs, expand it when and as required.

You can easily tie a new system in with the original installation. New storage facilities can be built where you want them, without regard to location of existing receiving areas. Airstream conveying lines carry your dry bulk material to its destination via the quickest route—horizontally, vertically, through walls and floors, underground or overhead. They fit any plant layout, new or old, and save you valuable space.

Ground level or rooftop installation eliminates costly supporting structures.

Merck & Co. recently took advantage of these features when they expanded their ground level Airstream System. In addition, use of duplicate components in the new system cut engineering costs. This also simplifies maintenance and permits minimum parts inventory.

Benefits like these tell you why it's smart to install a bulk handling system that is engineered to help you move ahead. Call or write Dracco now for detailed information.

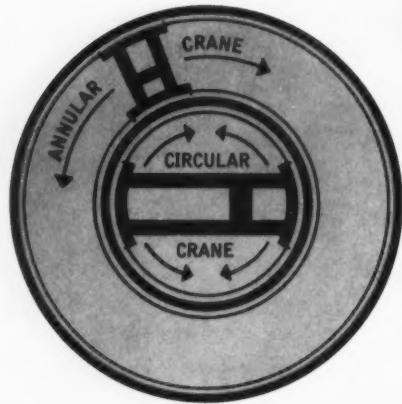
**DRACCO** DIVISION OF  
FULLER CO.  
4030 East 116th Street • Cleveland 5, Ohio

**DRACCO** *airstream conveyors*  
dust control equipment

(Pronounced Dray'co)

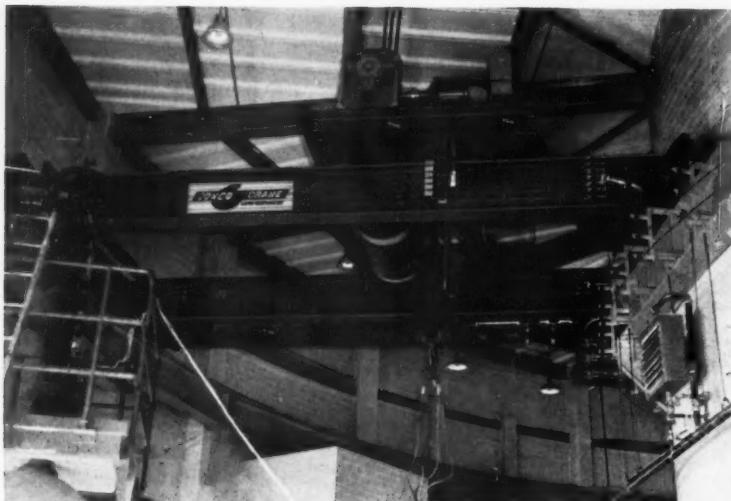
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**CIRCULAR**  
and **ANNULAR**  
**CRANES**

for a Pittsburgh Sewage Disposal Plant



This unique installation combines a 2-ton, 38'5" span circular crane and a 20-ton, 24'2" span annular crane, each with a 130' lift. One engineering problem solved: On the annular crane the outside wheels must travel at 195 FPM; the inside wheels at 125 FPM. Conco builds cranes for virtually every class of service, including specialized spark and explosion-proof cranes, two-hook cranes, and cranes employing closed-circuit TV remote control operation. A complete design service, including sample specifications, is available to consulting engineers. Write us for bulletin 5000A covering the Conco line of cranes, hoists and trolleys.



**CONCO ENGINEERING WORKS**

Division of H. D. Conkey & Company, Mendota 10, Ill.

AFFILIATE: Conco Building Products, Inc. - Brick, Tile, Stone

is necessary from a legal standpoint in letters. "Go to see the client, or telephone him, when you have something to report." And leave much of this personal contact to the engineer in charge of the project. This will be more satisfying to the engineer, and also give the client a broader acquaintance with various members of the consultant's staff.

### Delegating Authority

Speaking of staffs, this is another area in which the AMA teaches the engineer to improve his relationship. "Don't manipulate — motivate" is one of the prime lessons.

Many executives have difficulty delegating authority. These same men usually have other difficulties, such as getting and holding top men. "First, remember that doing everything yourself is not a sign that you are the only capable man in your organization. If it is, you had best take another look at your organization's personnel system," Schmidhauser began.

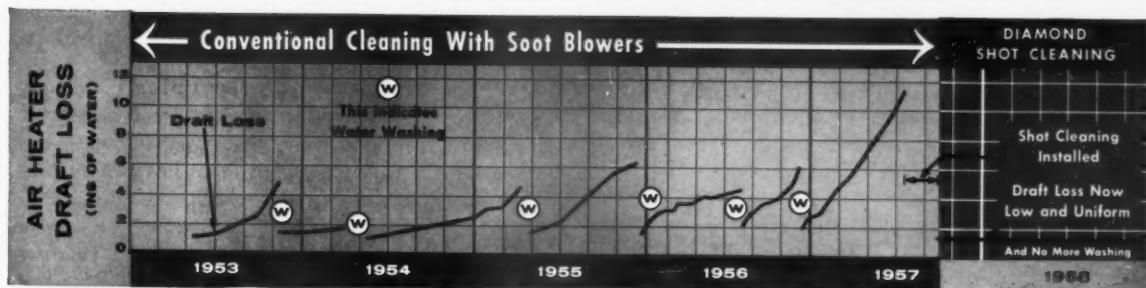
"It is an insecure man who cannot delegate work. He is afraid other men could do his work as well as, or better than, he can. Many men think they delegate work, but in reality they do not. The difference between delegating and not delegating is in the feedback. It is not delegating work if you give work to a man and tell him to report by Friday. It is delegating if you give it to him and leave the time and method to him."

Schmidhauser told of one firm which lost eight executive vice presidents within a period of about 10 years. Finally, before hiring the ninth vice president, the board interviewed the past eight. "They wound up with a new president, promoting the incumbent to the chairman of the board and giving him very clearly defined areas of responsibility. The reason they had been unable to keep men was that the president would delegate decision-making and responsibility, but keep the authority for himself.

# DIAMOND SHOT CLEANING

*Keeps TUBULAR AIR HEATERS CLEAN*

**that Could Not be CLEANED BEFORE**



Here is an example of how Diamond Shot Cleaning solves certain cleaning problems previously impossible of solution.

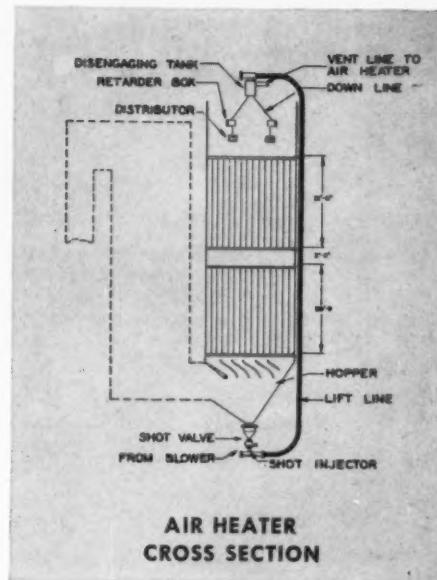
The chart shows increase in draft loss across a tubular air heater resulting from ineffective soot blower cleaning. Mounting draft loss caused decrease in fan capacity and reduction in load. During the first four years of operation it was necessary to water wash this air heater six times (at "W"). Each washing required a three day outage of the boiler.

Diamond Shot Cleaning was installed in September 1957. Since then draft loss has been minimum and uniform. Water washing with consequent boiler outage has been eliminated entirely.

This first installation was so successful that a second air heater was equipped with shot cleaning in 1958.

Diamond Shot Cleaning uses falling shot to clean horizontal tube surfaces such as superheaters, reheaters and economizers, as well as tubular air heaters. The shot is cascaded over the horizontal tubes or through vertical air heater tubes by distributors and scours the surfaces as it falls. Deposits are removed in small particles most of which are carried away by the gas stream. Heavier particles fall into the hopper and recirculate with the shot until broken fine enough to be picked up by the gases. Cleaning is thorough even with difficult fouling such as is found in black liquor fired boilers. Areas which tend to foul rapidly can be kept completely clean by increasing the automatic shot cycle (it may be continuous if necessary) without disturbing boiler operation.

In line with our half century policy of providing the best in boiler cleaning, Diamond has conducted extensive research on shot cleaning over a period of years. More than 30 installations are now in successful operation in United States . . . some of them since 1954. To supplement this program, Diamond has acquired the U.S. rights to the Broman-Ekstrom system, of which there are more than 800 successful installations in Europe.



AIR HEATER  
CROSS SECTION

WRITE FOR  
BULLETIN 2145-CE ON  
DIAMOND  
SHOT CLEANING

It has complete information, including data on shot lifting methods. For better boiler cleaning at lower cost, the answer always is Diamond.



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# Kohler Electric Plant safeguards Memorial Hospital

A 50 KW Kohler electric plant in this Sheboygan, Wisconsin hospital is ready to take over critical loads automatically—in emergencies when regular power

fails. Equipped with transfer switches and transformers, the plant will supply electricity for 115/230 volt single phase and 230 volt 3 phase normal service—insuring use of equipment vital to patients' care.

Kohler electric plants are thoroughly engineered package units, designed for specific purposes. They have all necessary features for easy installation, quick starting, quiet operation, minimum maintenance. Sizes to 100 KW, gasoline and diesel. Complete manual with suggested specifications sent on request. Write Dept. D-68.

**Model 50R51, 50 KW, 230 volt,  
3 phase, AC.**



KOHLER CO. Established 1873 KOHLER, WIS.

# KOHLER of KOHLER

Enamelled Iron and Vitreous China Plumbing Fixtures • Brass Fittings  
Electric Plants • Air-cooled Engines • Precision Controls

Incidentally, the new president was one of the previous eight."

Through the proper delegation of authority, an engineer can make his men "synergistic — greater than the sum of the parts." Nothing motivates like responsibility. "And remember, you can motivate a man to greater creativity, but you cannot manipulate him with the same results," Schmidhauser cautioned.

### Direction of the Staff

Internal staff problems usually should be solved by the staff or staff member. For instance, assume a consultant has an engineer on his staff who insists on going to conferences dressed as if he was on field assignment. Instead of telling the man to buy a suit and tie, call him in for a chat. Begin by noting that there has been a little criticism of the way the man dresses. Probably, the man will begin with a defensive lecture on comfort and his unwillingness to be a "sheep" led by public opinion. If you let him talk long enough, he will wind up deciding to modify his wardrobe. If this had been an order, the man might have rebelled.

During these evaluation sessions, the head of the firm should be willing to listen to criticism. "Tell me more" should be the basis of his approach. Usually the employee will cover the subject and then come around to realizing he was wrong. Frequently the boss may hear justifiable criticism.

Many of the AMA sessions are based on actual problems. For example, there was the consulting engineer who had an excellent secretary who was always late to work. The consultant first lectured the secretary, explaining that someone should be in the office at 9 a.m. Then he bought her an alarm clock. Next, he gave her extra pay for the days she was on time. And finally he fired her. (He had to rehire her later because he could not find a good replacement.)

It turned out that the consultant was at fault. Each day he would

# 6 Ljungstroms® go to work for the city of Memphis ...and so does lifetime Air Preheater service

The City of Memphis Light, Gas and Water Division has just installed three boilers served by six Ljungstrom preheaters. Why Ljungstrom preheaters? One reason is service. Air Preheater engineers don't just wait for a call. They regularly inspect and help maintain Ljungstroms *through the life of each unit*.

What's more, Air Preheater provides rapid *factory* service in an emergency. Here's an example. A customer phoned on a Friday morning for a

replacement trunnion—a major integral part of the preheaters. His Ljungstrom was 17 years old, which meant that a new trunnion had to be custom made to match his older-style. He was located 500 miles away. And he needed his boiler back on the line by Sunday.

Air Preheater went to work. Special trucking was arranged. The job was done *and shipped* that same evening. The customer had the trunnion by Saturday morning and the boiler was

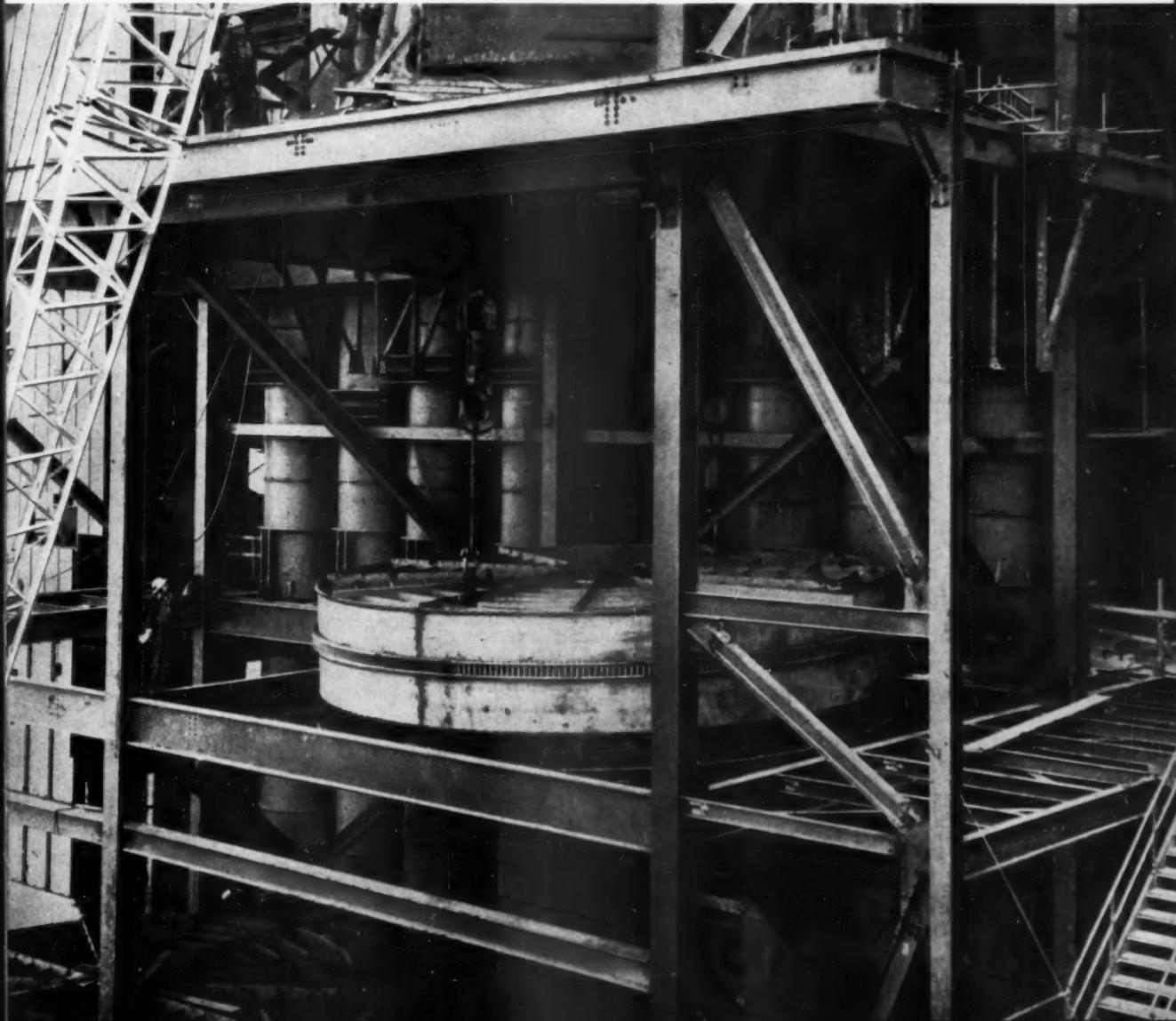
back on the line by Saturday evening!

Fast response to emergencies and regular inspection of Ljungstrom installations are two of the many advantages Air Preheater provides its customers. Another is expert knowledge of boiler and preheater problems—and how to lick them—gained from over 35 years of experience. Perhaps these reasons explain why 9 out of 10 preheaters sold today are Ljungstroms. For further information write today for free illustrated brochure.

## THE AIR PREHEATER CORPORATION

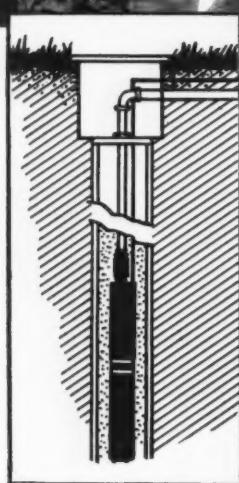
60 East 42nd Street, New York 17, N. Y.

Ljungstrom rotor being installed for the City of Memphis Light, Gas and Water Division. Six such Ljungstroms—each with 201,400 sq ft of heating surface—will serve three boilers. The boilers will each evaporate 2,000,000 lbs of steam/hr and have a combined nameplate capacity of 750,000 kw. A fourth boiler unit is now under consideration. Burns and Roe, Inc. designed and supervised construction.





## Picture of a 2000 gpm SUMO Submersible water pump installation!



Yes! That's the beauty of a Sumo Submersible. No pump house or other protection is needed to safeguard the motor against freezing, dampness or tampering. The Sumo Submersible operates completely inside the well — pump and motor both — under water.

The idea is not new. It's not radical. It's just plain commonsense engineering as Sumo has proved after almost 50 years of specializing in the submersible pump field. The motor is coupled directly to the pump and forms a complete, compact unit that makes more efficient use of power . . . provides a neater, simpler installation . . . and assures long, troublefree operation.

Sumo Submersible Pumps come in a full range of sizes up to 120 hp with capacities to 2000 gpm. Consider their use for any deep well requirement whether it be commercial, industrial or municipal. They'll quickly pay for themselves.

Write for information. Ask for literature on Sumo high-capacity pumps. For specific recommendations, state your water requirements and the depth of the well. Engineering assistance is always available without obligation.



### SUMO SUBMERSIBLE DRAINER PUMPS

For pumping water containing up to 20% solids. Ideal for dewatering or flooding or use in areas where internal combustion engine driven pumps present a hazard. Capacities up to 400 gpm. Write for literature.



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The Complete Line from 1/3 hp to 120 hp

come to work about 10 a.m. Then about 4:30 p.m., he would give dictation, insisting that the work be completed that night. Since he was not around to sign the letters and would not let his secretary sign for him, the mail could not go out until the next day. Naturally, the secretary was frustrated by this situation.

The problem finally was solved when they both started coming to the office at 9 a.m.

#### Branch Office Problems

Another big problem for the consulting engineer is getting along with the men in his branch offices. To do this well he should understand his own role with the company, and the fields in which he excels. Then he should ask the staff to let him know when he can assist them.

What if, after he tells them to let him know when he is needed, he does not hear from the branch offices? "Perhaps he should admit that he might not be needed there, and save the expense of a trip," Schmidhauser said. Also if he drops in on a visit, unannounced, he should make sure that he does not give the impression that he has no confidence in his men and is there to check on them.

In all cases, an office is as good as its management. "Remember that bulletin board ultimatums do no good. Hire good men, let them set their own standards, and they will live up to them," Schmidhauser concluded.

#### Hiring Techniques

What about the scientific tests for hiring men? Schmidhauser said there is nothing wrong with the method. But when it is used, special care should be taken to give the man more than the usual amount of personal attention when he first starts the job.

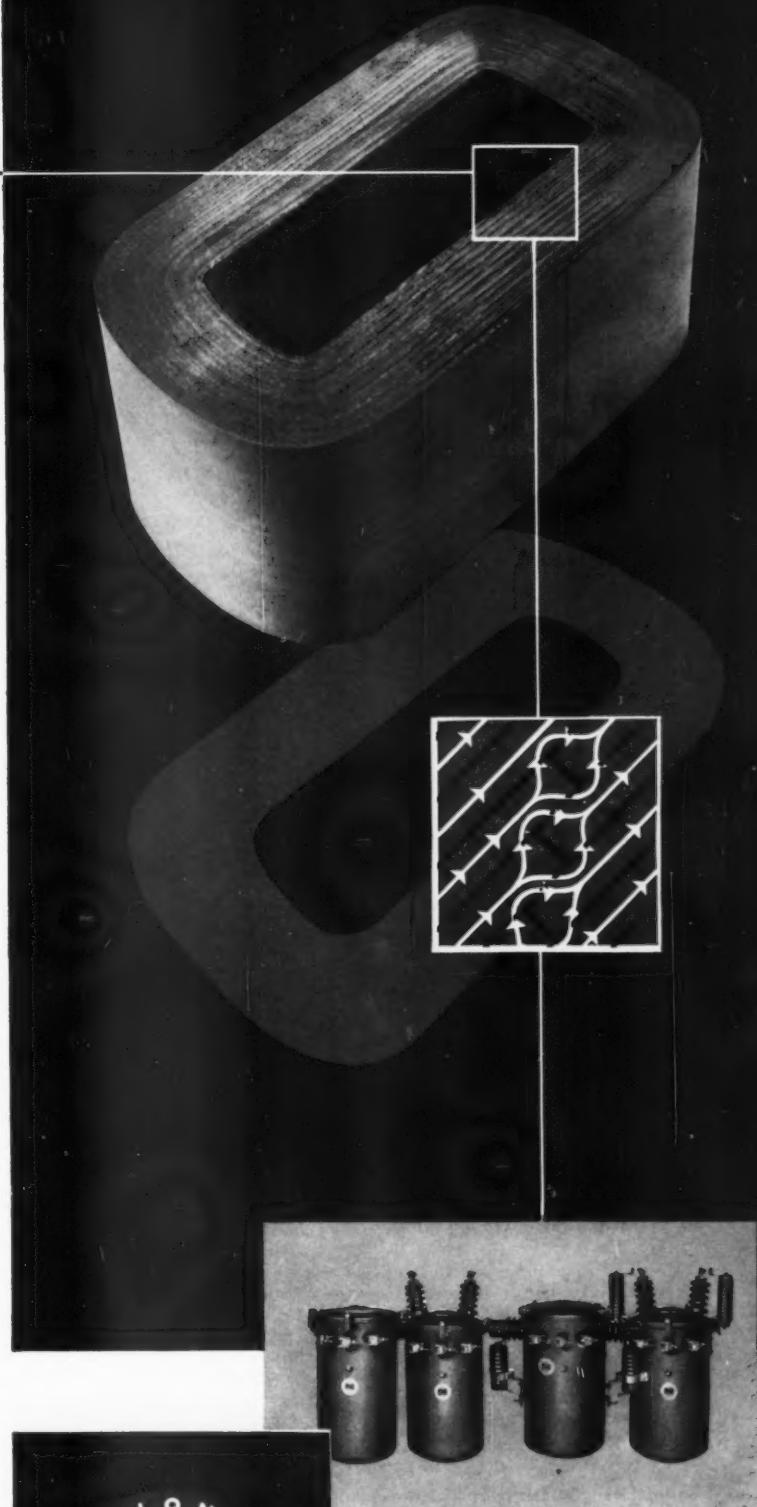
"Men are not machines and cannot be treated as such. After all, it costs \$8000 to \$10,000 to train a young engineer during his first year

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CORE...  
DESIGNED FOR  
PERFORMANCE**

Developed by Moloney engineers for use in distribution transformers, the MOLONEY CORE is made of single-turn, cold-rolled, grain-oriented, silicon steel laminations having the ends butted one against the other. To accomplish a high permeability path for the magnetic lines of force and reduce flux density at the gaps, the butt joints are distributed over one entire side of the core and arranged so that adjacent laminations do not have air gaps opposite each other. After the core is formed, it undergoes an annealing process to relieve any mechanical stresses introduced during manufacture.

The MOLONEY CORE is a compact core having low losses and exciting current, thereby keeping operational costs to a minimum, and is the result of research and development programs dedicated to the continued improvement of Moloney Transformers... Specify Moloney Transformers... All Along the Line.

MES9-2



*Manufacturers of Transformers*

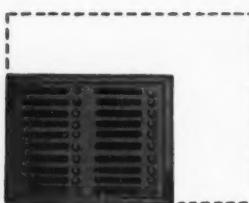
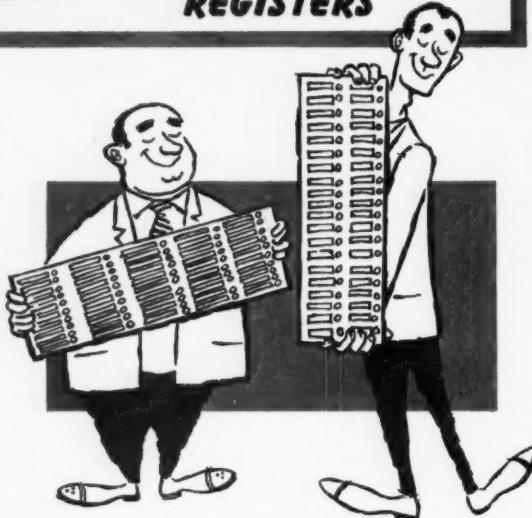
*for Utilities, Industry, and Electronic Applications*

**FACTORIES AT ST. LOUIS 20, MO.  
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## MODULAR STAFF IN-AND-OUT REGISTERS

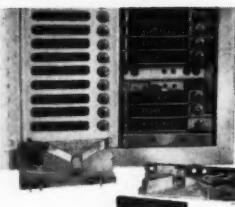
AVAILABLE  
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### WITHOUT SACRIFICING AREA FOR NAMES

Modular design makes Couch registers available in many name capacities and height-to-width ratios at competitive prices. Flexible grouping of unique plug-in name-tile units requires less than half the space used in other registers — without sacrifice to name area. Name tiles and long life lamps can be quickly changed by simply withdrawing the plug-in unit.



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To see how you can have a custom-built register system at standard system cost, write today for Bulletin H9.

S. H.

Couch

Company, Inc.

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on the job. The little bit of extra attention needed to make him feel that he is an individual with something to contribute will not be missed. Without it, you may lose a good man.

"Know the men you are hiring," Schmidhauser added, "their ambitions are all important." For instance, if you need a draftsman you can hire a young engineer, promote him after a time, and hire another draftsman. But if you want to hire a draftsman who will remain a draftsman, make sure you are getting a technician with no ambitions.

#### Professionals All Alike

Asked how consulting engineers compare to other executives in their ability to get along with people Schmidhauser said, "The proper breakdown would be to compare all professional people to other executives. The professionals' problems and personalities are akin. For instance, one minister and an engineer found they were having the same trouble with people. The engineer's employees reacted like the minister's Ladies Aid. They were too nice, and never said what they thought. Neither man was approaching his people in a correct and positive manner."

Professionals have another common problem. They tend to be dogmatic. "Their training as specialists gives them a narrow frame of reference," Schmidhauser explained. "All professionals should read more, outside their fields of specialty. Yet professionals, and especially engineers, are poor readers. A person can learn to read between 1100 and 1200 words per minute, on material he is reading for pleasure. Many engineers read only about 250 words a minute." This comes from too-frequent tangling with technical papers.

Schmidhauser suggested that all engineers who have this problem should take a night course to increase their reading speed. As speed increases, comprehension usually follows suit.

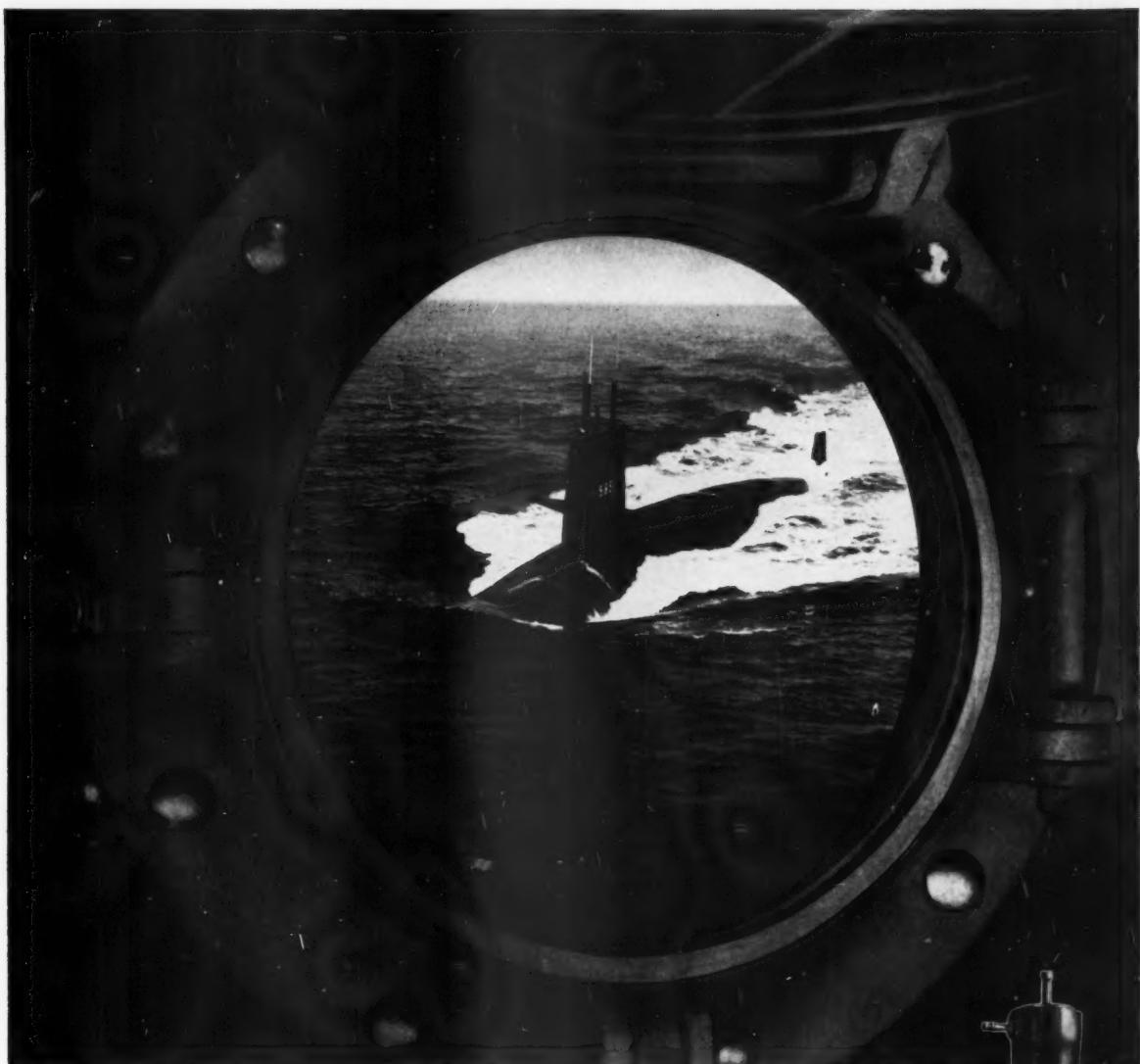


Photo by General Dynamics

## IN THE NAVY'S NEW NUCLEAR FLEET

*Darling Stainless Steel Valves are "on duty"*

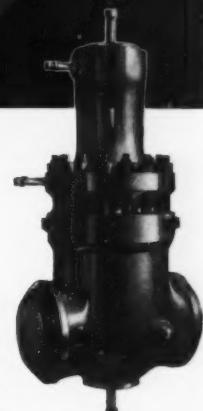
Meeting the Navy's rigid specifications for valves in nuclear power plants demands the highest quality and production standards.

Darling is one of the select group of manufacturers supplying stainless steel valves for the Navy's new nuclear submarines. Darling valves are "on duty" on the Skipjack, as well as other nuclear subs still unnamed. These valves incorporate the *exclusive revolving*

*double disc parallel seat feature*... which insures positive sealing and ease of operation.

This Navy acceptance of Darling quality standards holds important implications for designers and builders of commercial atomic power plants. Our know-how and precision manufacturing facilities are at your disposal.

Write us for information, or we'll gladly arrange for a Darling sales engineer to call.



Darling 14" stainless steel gate valve of the type used on the Skipjack.



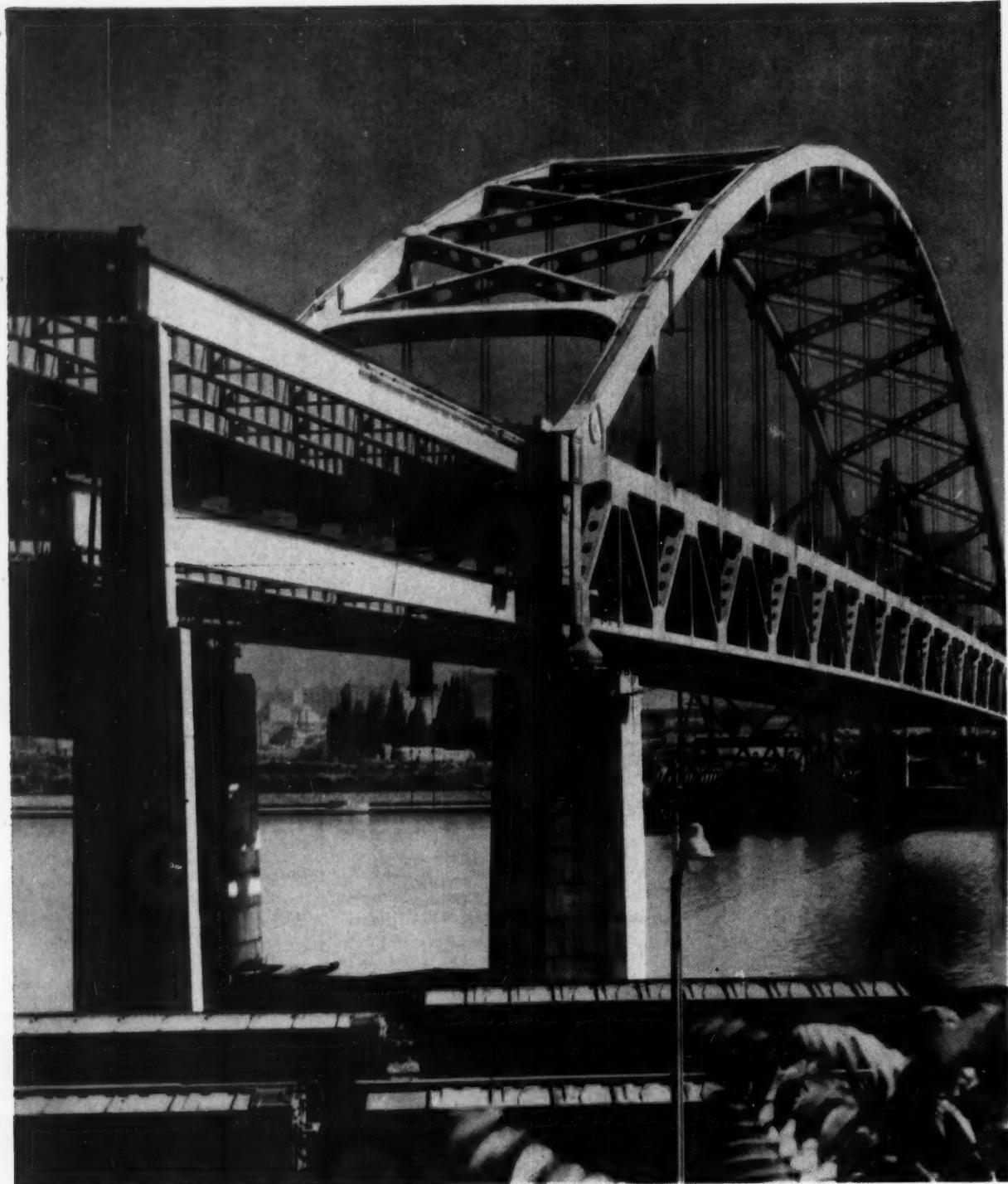
### DARLING VALVE & MANUFACTURING CO.

Williamsport 5, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

Only span of its kind in the world . . .

# New Fort Pitt Bridge built with cost-saving





# MAN-TEN High-Strength Steel



Under the shiny new paint on Pittsburgh's Fort Pitt Bridge is a steel with a reputation—USS MAN-TEN High-Strength Steel. More than two-thirds of the 8,000 tons of steel in the 750-foot span is USS MAN-TEN brand—a steel that delivers high strength (50,000 psi min. yield point) with economy.

The bridge is regarded by engineers as the most unusual structure in the entire Penn-Lincoln Parkway System. It is a double-deck, tied-arch design and will carry four lanes of one-way traffic on each level.

For the heavily stressed members, high-strength steel answered the problem of getting higher allowable stress per dollar by avoiding unnecessary weight. USS MAN-TEN Steel was used in all chords, most diagonals and verticals, and all portal members including end floor beams. The roadways are supported by 112 pre-stressed USS Tiger Brand suspender ropes, each  $3\frac{1}{4}$ " in diameter with an ultimate strength of 475 tons.

Other USS High-Strength Steels available for construction include USS TRI-TEN High-Strength Low-Alloy Steel which, like USS MAN-TEN, has minimum yield point of 50,000 psi and which is particularly recommended for welded structures. USS COR-TEN High-Strength Low-Alloy Steel also has a

50,000 psi minimum yield point and, because of its outstanding resistance to atmospheric corrosion and superior paint adherence qualities, is a "natural" for riveted structures located in corrosive areas. Where an extra high yield strength steel is needed, we offer USS "T-1" Constructional Alloy Steel which combines weldability and toughness with 100,000 psi minimum yield strength.

For complete information on any of these steels, write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS, MAN-TEN, COR-TEN, TRI-TEN, "T-1" and TIGER BRAND are registered trademarks

**New color movie available—"Challenge at Carquinez."** A 27-minute, 16mm. color film showing the design and construction of the unique Carquinez Strait Bridge. Ideal for engineering groups. For booking information write United States Steel, Pittsburgh Film Distribution Center, 525 William Penn Place, Pittsburgh 30, Pa.

United States Steel Corporation - Pittsburgh

American Steel & Wire - Cleveland

Columbia-Geneva Steel - San Francisco

Tennessee Coal & Iron - Fairfield, Alabama

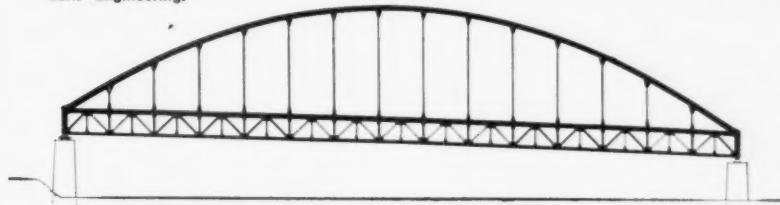
United States Steel Supply - Steel Service Centers

United States Steel Export Company

## United States Steel

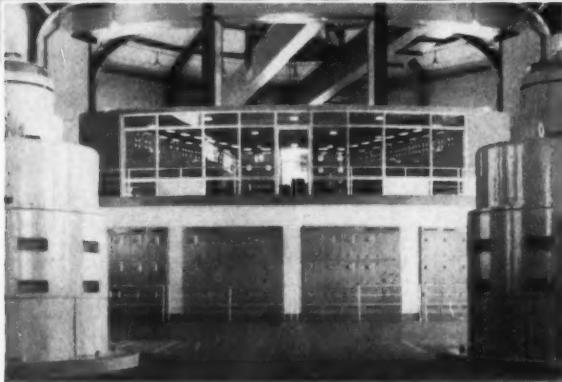


**Some of the men who played major roles in making the new Fort Pitt Bridge at Pittsburgh a reality:** left to right are Alan A. Porter, American Bridge Division's Vice President—Construction; George S. Richardson, consulting engineer, designer of the bridge; Leonard J. Curran, District Engineer, Pennsylvania Department of Highways; and Arthur S. Marvin, American Bridge Division's Vice President—Engineering.



**Where high-strength steel saves money.** Profile of bridge showing parts made of USS MAN-TEN Steel in heavy lines. For these members, MAN-TEN Steel's high strength and relatively low cost made it the economical steel to use.

One of two (2) main operating corridors showing individual filter control stations whose modern design permits initiating and carrying out the backwash cycle automatically.



A view of the pump controls framed between two of the vertical motors. Enclosed control center contains all instrumentation necessary for monitoring operation of station. Large dial gauges provide continuous indication of station performance.

**CITY OF DETROIT**  
Department of Water Supply  
**NORTHEAST FILTER PLANT & PUMPING STATION**  
**Gerald Remus, Dept. Gen. Mgr.**

General Contractors  
**Bryant & Detweller, Detroit (Pumping Station & Foundation)**  
**Grove-Sheppard, Wilson & Krug, New York (Filter Bldg.)**

Equipment Contractors  
**Municipal Service Co., Kansas City (Filter Equipment)**  
**Stanley Carter Co., Detroit (Metering Equipment)**



Plant engineer, George Dehem, inspects an individual filter control station with one of his filter attendants. All filter operation is supervised from this control panel.

\*\*\*\*\*  
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**ONE RESPONSIBILITY**



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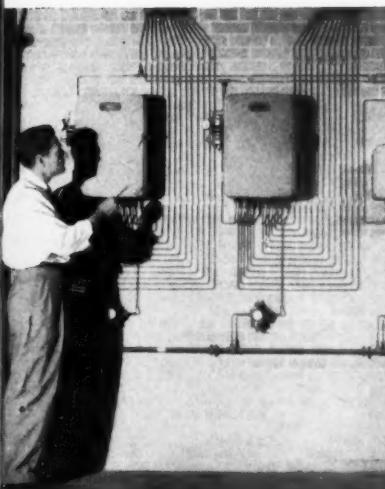
## Detroit Equips New Northeast Filter Plant with INTEGRATED EQUIPMENT OF PROVEN PERFORMANCE FROM "SINGLE RESPONSIBILITY" SOURCE!

**Modern Builders-Providence Controls and Equipment Installed at Detroit's  
192,000,000 GPD Water Supply System**

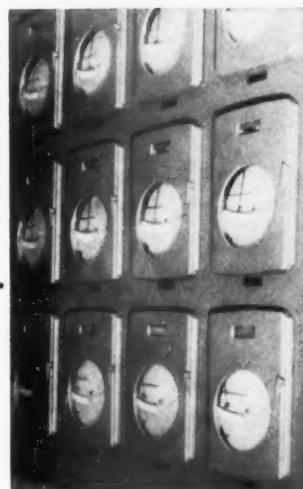
Supplying the tremendous water demands of the country's fifth largest municipality is no small task. The complex nature of such an operation requires complete integration of all control equipment . . . for maximum efficiency, operation economy and systems reliability.

B-I-F Industries as a single, responsible source . . . offering nationwide sales and service through local offices . . . was able to supply the type of equipment (supervisory control, filter control, chemical feeding and related functions) that means immediate and long term savings in time and money. For particulars, write

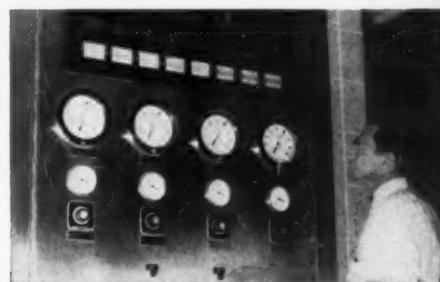
**B-I-F Industries, Inc., 512 Harris Ave., Providence, Rhode Island.**



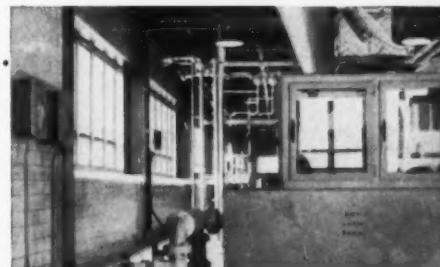
Each of these filter effluent flow summation units totalizes the flows through 12 individual filters and transmits a signal proportional to total flow to instruments located at key locations throughout the plant. In addition, the output of the four summation units is added to obtain total plant flow.



All plant functions for which permanent operating records are required are displayed on this central recorder panel thus permitting operating personnel to note trends of the various functions and departures from normal conditions.



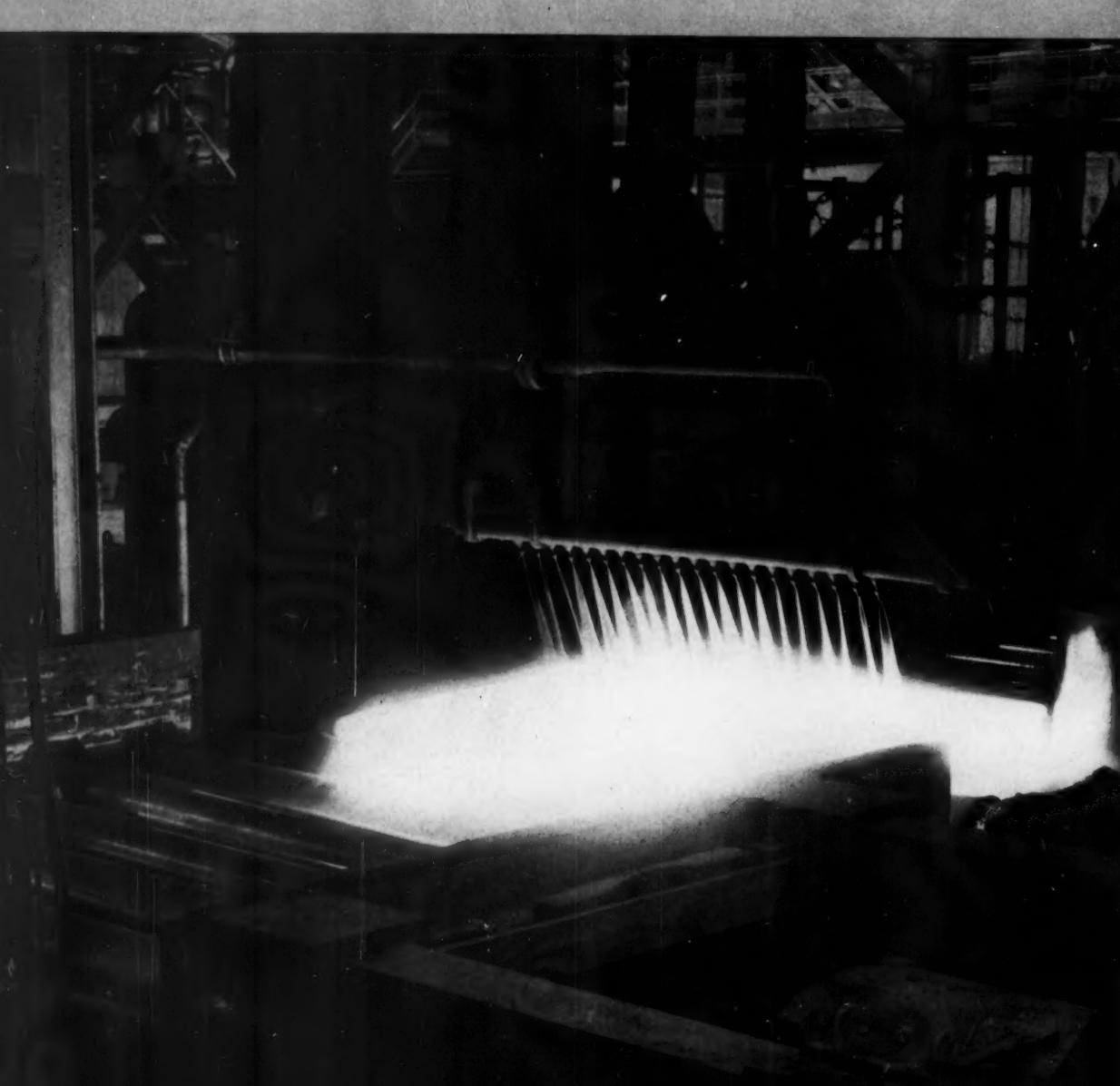
From this filter master control and annunciation panel, the flows through four batteries of twelve filters each can be observed and regulated to meet varying demands. Audible alarms and lights indicate any departure from desired conditions . . . allow operator to maintain optimum operation.



One of the Omega Gravimetric feeders used for alum — others are used for activated carbon. These units provide reliable and accurate proportioning of chemicals to water being treated regardless of plant output variation.

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**CENTRIFUGAL**  
**PUMPS**

**for high-pressure**

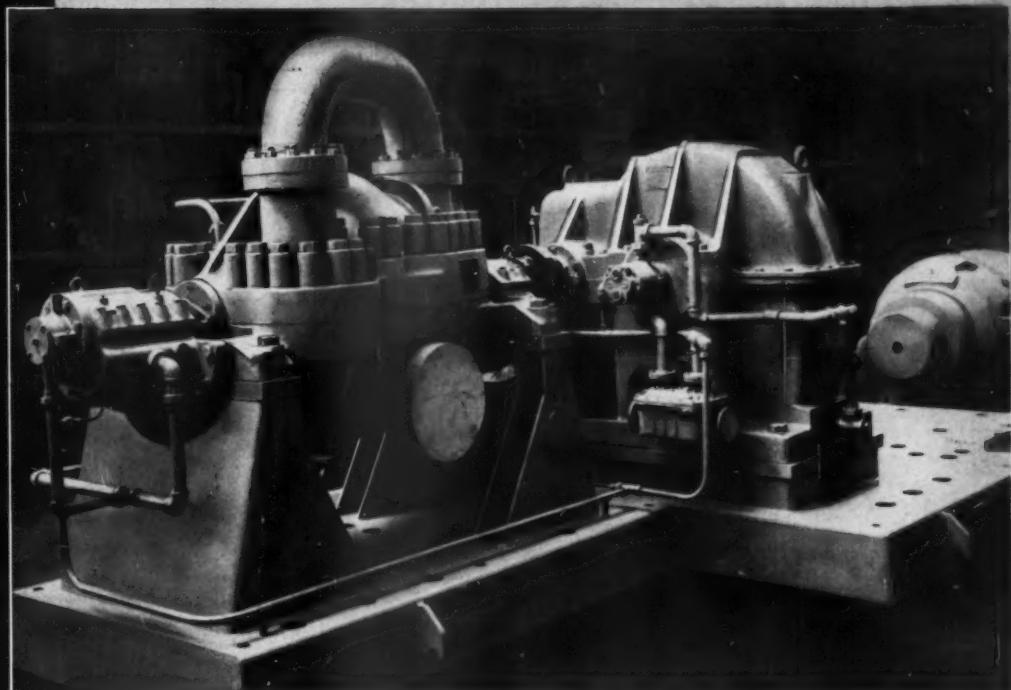


# descaling at Lukens Steel

Latest successful technique of high-pressure descaling is now being performed in this modern steelmaking facility designed by Mesta Machine Co.

The initial high-pressure descaling operation uses De Laval split-case multi-stage pumps as shown in the photograph below. Each pump supplies cold water at 1000 gpm and 1600 psig. Electric motors rated at 1750 hp drive the pumps through speed increasers which raise the speed from 1200 rpm to 4250 rpm.

De Laval pumps also serve Lukens on a 1200 psig descaling system in another section of the Coatesville, Pa. mill.



One of several arrangements available for descaling service at pressures of 1000-1200-1600 psig and capacities to 2200 gpm.



**DE LAVAL**

*Steam Turbine Company*

894 NOTTINGHAM WAY, TRENTON 2, NEW JERSEY



## The Word From Washington

EDGAR A. POE  
Consulting Engineer Correspondent

**PLANNED RETIREMENT PROGRAMS** are being used by only 3 out of 10 professional people, according to a survey of 30,000 persons by the Bank of New York. The survey, which attracted some attention on Capitol Hill, showed that 7 of every 10 professionals were self-employed.

The research also showed that 19 out of every 20 persons would set up a retirement plan if Congress authorizes the use of deferred tax dollars as provided under the House-passed Keogh-Simpson bill. The measure would permit \$2500 a year tax deferral. It is identical to the bill which passed the House in 1958, but died in the Senate because of objections raised by the Treasury Department.

### Refractory Castables

The National Bureau of Standards has been investigating for some time the preparation and properties of heat-resistant concretes, commonly known as refractory castables. These castables are prepared from a mixture of aluminous cements and heat resistant aggregates. When combined with water, the mixture can be cast like concrete. After curing, the cast is suitable for use over a wide range of temperatures.

The Bureau says a typical application was the construction of

missile-launching pads at Cape Canaveral, Florida. Refractory castables also are used in furnaces where heat-resistant lining is required, as in the steel and ceramics industries.

### Power Load Will Triple

Electric energy requirements by 1980 may be nearly three times actual use in 1958, the Federal Power Commission staff estimates. Secretary of Interior Fred A. Seaton declares it is vital to the Nation that the costs of electric energy produced from conventional fuels be reduced. Improved utilization must be achieved to narrow the gap between the cost of hydro and fuel produced energy.

The electric utility industry consumed 156-million tons of coal in 1958, but a consumption rise to 400-million tons is estimated by 1980. In addition to coal, the industry consumed 78-million barrels of oil and 1373-billion cubic feet of gas.

Although future hydro developments are limited, there is a substantial Federal construction program under way that will contribute to the Nation's over-all supply. Programmed by the Corps of Engineers and the Bureau of Reclamation, the additional hydroelectric capacity includes: 1960, 620,000 kw; 1961, 603,000 kw;

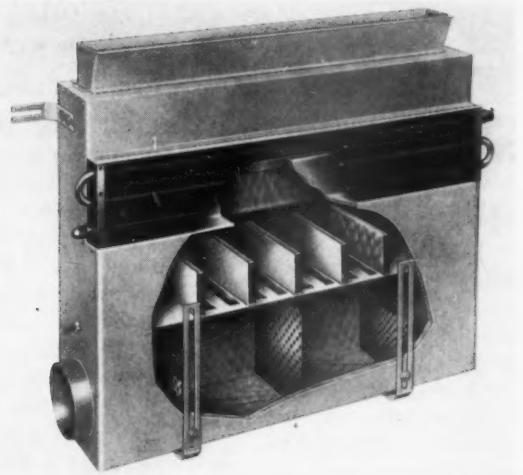
1962, 367,000 kw; 1963, 688,000 kw, and 1964, 837,000 kw.

While growth is expected to continue at a rapid rate, hydro output will be a decreasing percentage of the total power supply. It is expected that hydroelectric plants will provide 15 percent of total production by 1970, and only 12 percent by 1980.

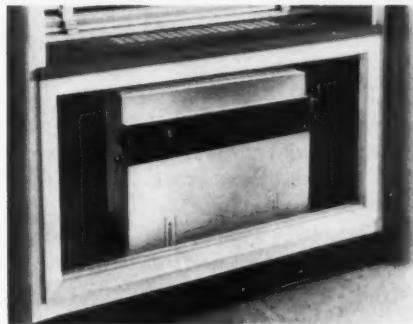
### Salt Water Conversion

The chief of the Saline Water Division, Dr. A. L. Miller, declares that many sections of the Nation eventually will find it more economical to distill sea water into fresh water than to develop conventional supplies. Presently operated salt water conversion plants do the job all right, but the costs are high. Dr. Miller says, "We expect our demonstration plants, and the stepped up research programs under way, to bring the conversion costs down to about \$1 per 1000 gallons."

As conversion costs drop, development costs of new fresh water supplies continue to go up. Presently the Nation is using 240-billion gpd. Ten years from now Federal officials estimate the demand will be at least 500 or 600-billion gpd. Our population is growing by 8000 every day, and by 250,000 every month. In the year 2000, just 41 years from now, the



Furred-in arrangement permits custom matching of building architecture. Recirculation grille supplied with frame to facilitate plastering-in. Cabinet enclosures which can be painted to match room décor also available.



## New Carrier 37E All-Air Weathermaster

*—only high-velocity terminal with reheat coil!*

Simplicity is the keynote of the new Carrier 37E All-Air Weathermaster\*, the only room terminal currently available which provides a reheat coil for high-velocity constant volume single duct systems. These units require no electrical connections, no motors or other moving parts, no filters or condensate drains. And they save valuable building space because they permit the use of compact high-velocity air distribution systems.

Installation is made easy by a choice of right or left hand duct connection, right or left hand connection to the heating coil (steam or hot water, 3 or 5 row), and by the availability of a complete line of accessories for cabinet or furred-in arrangements.

The single duct system with reheat at the unit is acknowledged to be functionally the best possible for maintaining close control of conditions in individual rooms of office buildings, hospitals, hotels, and similar structures, new or old. It is an ideal choice for modernization of a building where the design sensible cooling load is relatively low and where a serviceable steam or hot water heating plant is available.

In addition to the 37E, there's a new Carrier 37D All-Air Weathermaster for double duct systems. For complete information about the new units, call your nearest Carrier office. Or write Carrier Corporation, Syracuse 1, New York.

\*Reg. U.S. Pat. Off.

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# **NEW DATA —**

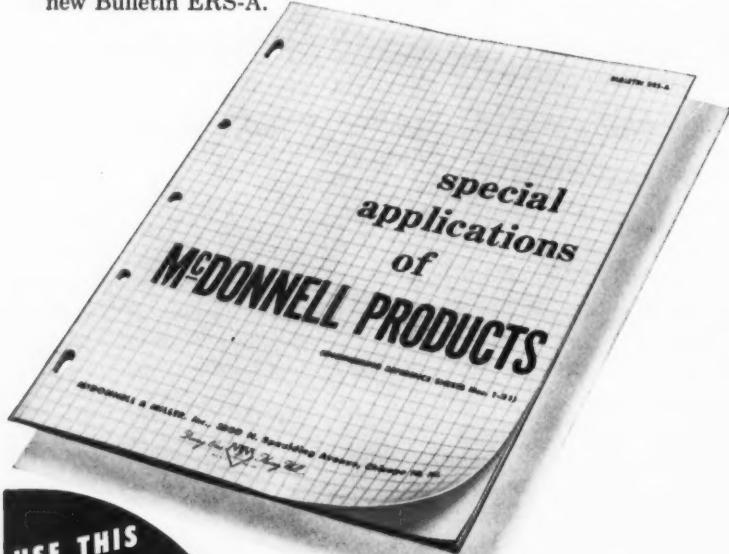
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This new book shows how McDonnell float-operated switches and valves, and flow switches, can be used to provide dependable, economical control for a wide variety of applications.

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United States population may have reached a total of 350 million.

## Wire Conductor Vibration

The National Bureau of Standards is studying wind-induced vibration of wire conductors. Their goal is the reduction of breakage and wear. Under sponsorship of the Rural Electrification Administration, the research is part of a continuing program of technical aid to REA involving telephone and power line investigation.

A study concentrating on the vibration of conductors became necessary with the introduction of long-span construction in an effort to provide economical service in rural areas. Vibration induced conductor wear, at the ties and armor rods, causes frequent breakage in cold weather. Engineers now maintain that many conductor breaks ascribed to ice and sleet storms actually occur in conductors weakened by wind vibrations.

### **Federal vs. Private Power**

The extreme liberals in this country, who have long cherished the hope and belief that the Federal Government should dominate the power industry, have by no means given up. This has been apparent during debate on the question of investor-owned power versus public power in the current Congress.

One of the most obvious political pieces of legislation to reach the floor this session was the so-called anti-Benson bill. Although the measure itself was relatively unimportant, the bill would have stripped the Secretary of Agriculture of his power over the Rural Electrification Administration. REA Administrator David A. Hamil testified before Committee that he and Mr. Benson had never been at loggerheads, nor had the Cabinet officer reversed him on a single major REA loan.

## Atomic Energy Control

**The Chamber of Commerce of the  
United States, in a statement to**



LIGHTING

PRESENTS

## SLIMFIN

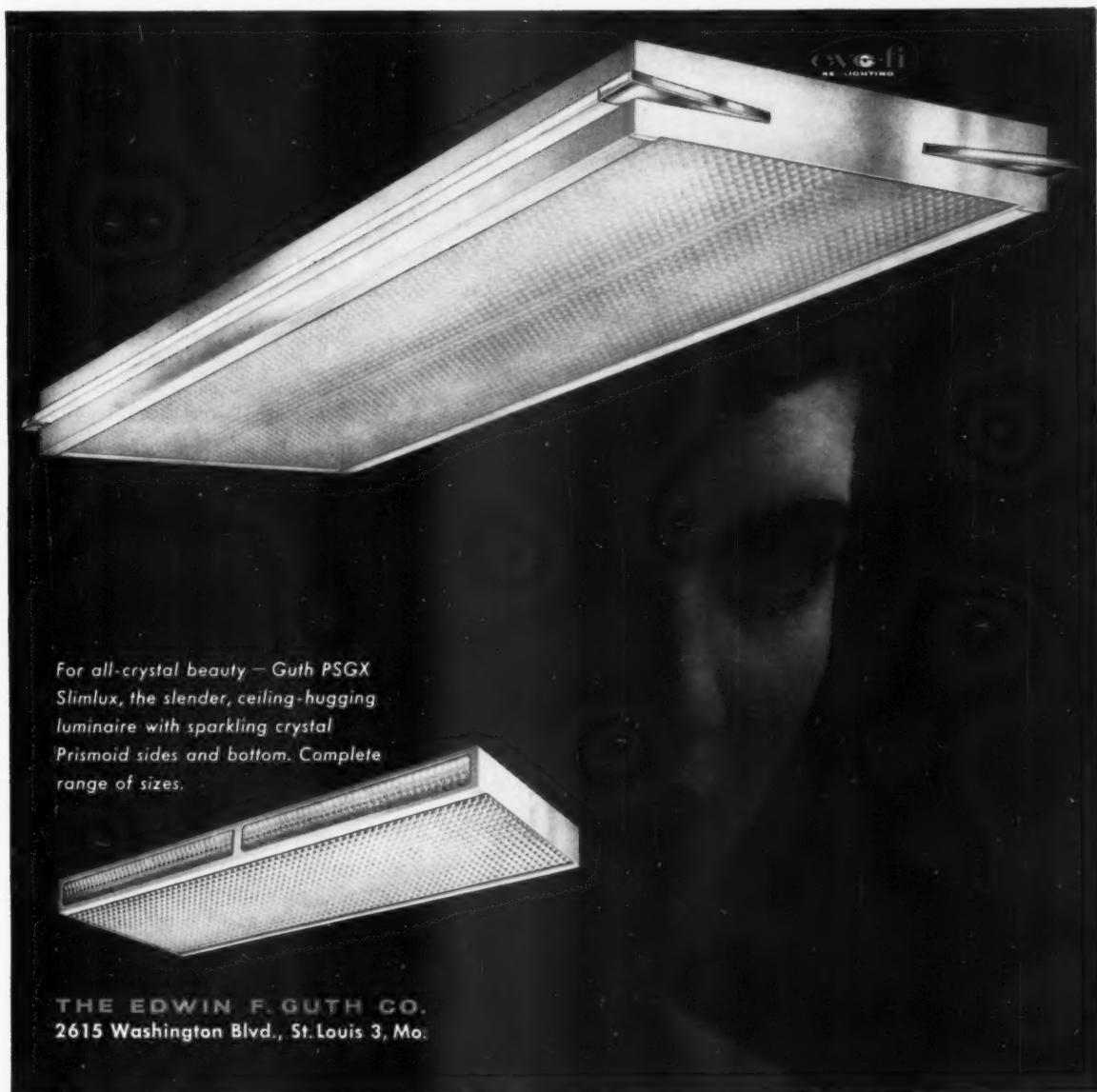
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Consulting Engineer: J. E. Curley & Assoc.

A prize-winning architectural achievement, the Dupont Plaza Center in downtown Miami is designed for the merchandising of building products and related items.

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- Maid's call for selective location of maids.

- Complete sound system for the architects' sample bureau.

- Large number of selector stations which permit selection of the 11 programs going on for distribution to any point.

- Latest master antenna equipment, closed circuit systems, large projection TV sets, and intercom facilities between message centers.

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Congress, declares that authority to regulate all peace-time atomic energy activities should be transferred to the States in the interest of public health, safety, and growth.

The Chamber, regarded as the voice of business, represents 3450 business organizations with an underlying membership of 2.5 million businessmen. On the question of waste disposal, army reactor safety measures, transportation of nuclear materials in interstate commerce, and construction of Federal atomic facilities, Federal regulation is advocated by the Chamber.

### Federal Per Diem Rates

It appears unlikely that this session of Congress will raise the current low per diem fee limitations for consulting engineers performing intermittent professional services on Federal Government projects.

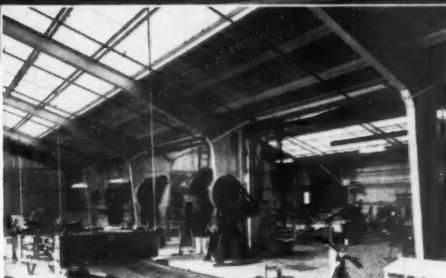
Consultants are going to have to write their congressmen urging the increase before the law-makers provide the raise. The House and Senate appropriation measures generally have been fixing the per diem allowance at \$75. The National Society of Professional Engineers says Federal agencies are utilizing more and more consulting engineers for highly specialized and complex jobs. The NSPE, in urging Congress to raise the fee, maintains that a Federal limitation of less than \$100 per day may prevent qualified consulting engineering firms from undertaking engineering projects for the Government.

### Top Government Posts

A series of hurdles still faces the pending Congressional request of the Army, Navy, and Air Force for a total of 158 additional top level engineering and scientific positions that will pay up to \$19,000 a year. There are authorizations at present for 292 of these top drawer positions, and the pending legislation would authorize an increase to 450.

The Defense Department also has a request pending before Congress to authorize an increase in the





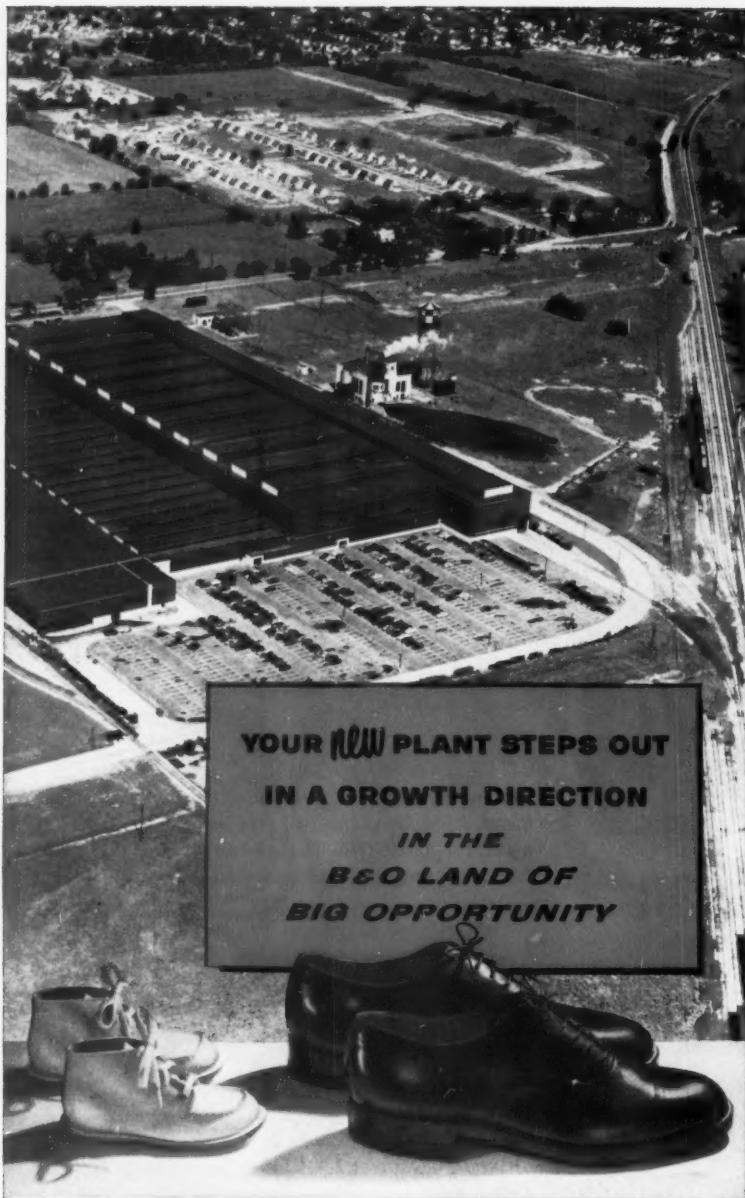
This Parkersburg SF Series multiple metal building was erected for a West Virginia metal product manufacturer. Original plans called for a 60' x 120' building. Before completion of the first building the manufacturer decided to double his capacity. Two weeks after the second unit arrived at the job site, machinery was moving in and production was underway.

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#### Highway Construction

Pointing to the tremendous development being made in highway construction equipment, H. A. Radzikowski, chief of the division of development of the Bureau of Public Roads, declares that new equipment is far superior to that of only a few years ago. Said he, "If it had not been for the ability of equipment manufacturers and contractors to increase machine production at a rate to offset to a considerable extent the rise in other costs, the expanded highway program would not be economically feasible. For example, it costs no more today to move a yard of dirt than it did over 30 years ago, although other factors which contribute to earth-moving costs, including labor and materials, have increased 300 percent during the same period."

To illustrate Radzikowski's point, the Bureau recently reported several new developments in land clearing equipment permitting the highway contractor to prepare timbered rights-of-way at only a fraction of the cost of a few years ago. A new clearing blade, mounted on a large crawler tractor, quickly shears off tree trunks at stump height or flush with the ground. If the trunk is too large to cut in one piece, it can be split in two with a sharpened prong called a "stinger." The land clearing device also may be used for destumping, stacking, ditching, and top soil removal.

#### Russian Engineering

Major General E. C. Itschner, chief of the Corps of Engineers, presented to Congress a meaty and detailed report of Russian activities in water resources development, and engineering activities. As to the quality of Russian engineering, he said a British technical delegation inspected some of their many projects and reported: "Rus-

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Convector Radiators Catalog Nos. 4049-A & 4150

Permaheat® Baseboard Convector Catalog No. 4354-A

sian engineers are not lacking in engineering ability when dealing with the varied problems met in river control and development works . . . They have been most successful with the projects they have attempted and they are obviously backed with sufficient technical know-how and experience to enable them to deal with any difficulties which may arise."

General Itschner said Soviet demands for building materials, including concrete, are great. Consequently, engineers lean toward building very large earth and rock fill dams, using concrete only for critical portions such as locks, spillways, and power plants.

**AEC Hanford Works**

Preliminary construction activity on the Atomic Energy Commission's \$145-million new production reactor at Hanford Works, Richland, Washington, will begin this summer. Heavy construction will not start until the summer of 1960. Initial operation of the reactor will probably be scheduled for the autumn of 1962.

The proposal of Kaiser Engineers, Oakland, California, to perform the work was selected from 14 bids. Of the total outlay, estimated cost of the contract with Kaiser Engineers is expected to be about \$100 million. Design and engineering work on the reactor is being performed by General Electric Company, the AEC's prime operating contractor at Hanford. Burns and Roe, New York, are supplying architect-engineering services for the heat dissipation and supporting facilities.

**Postal Rates**

There will not be a postal rate increase this year for the simple reason there is no enthusiasm for one. The Post Office Department seeks a \$550 million increase. The Department has recommended, among other things, that first class letters be increased to 5 cents, and air mail to 8 cents. ▲▲

another G-E  
PROJECT  
'8000'  
development

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NEW CUSTOM '8000' MOTORS GIVE TOP PERFORMANCE WITH LESS MAINTENANCE . . . HERE'S WHY

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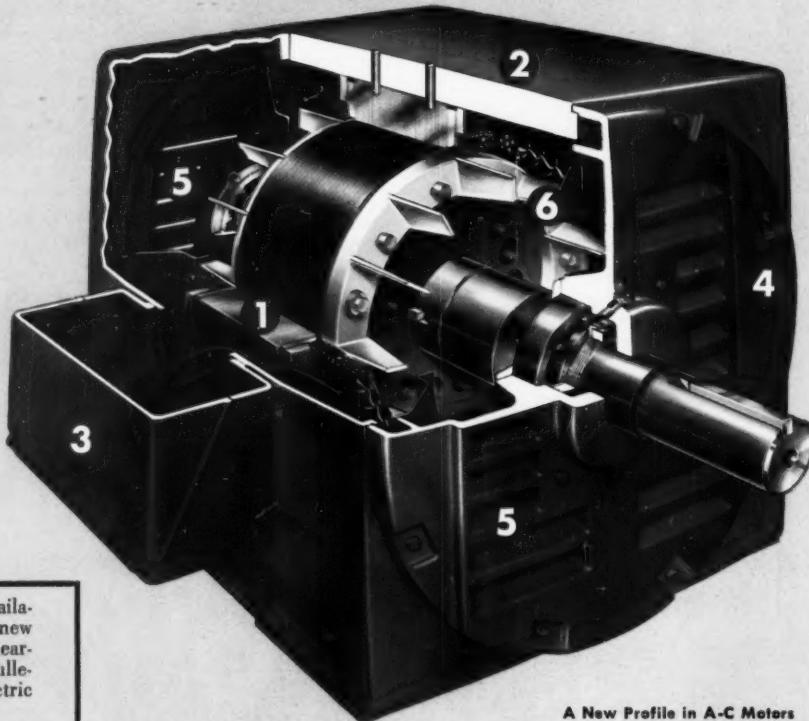
FROM GENERAL ELECTRIC . . .

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PROJECT  
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## NEW Custom '8000'\* Motors Give Greater Reliability Require Less Maintenance

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- 2 BETTER CONSTRUCTION—Cast iron frame withstands 20G simulated transportation shock tests; resists corrosion.
- 3 FASTER INSTALLATION—Conduit box has up to 3 times volume of ordinary boxes; lifting lugs, cast to frame, hold up to 12 times motor weight.
- 4 EASIER MAINTENANCE—Flat end shields are more adaptable to addition of accessories or modifications; are lighter—easily handled by one or two men.
- 5 BETTER COOLING—Double-end ventilation, new duct design and louvered air openings provide more efficient air distribution through motor, reduce hot spots.
- 6 LOWER NOISE LEVEL—Sound power has been cut up to 50% by redesigning frame sections, rotor fans, air deflectors and intakes.

FOR COMPLETE INFORMATION and availability dates about General Electric's new Custom '8000' motor line, contact your nearby Apparatus Sales Office, or write for bulletin GEA-6865, Section 884-2, General Electric Co., Schenectady, N. Y.



A New Profile in A-C Motors  
150 to 6000-hp

### NEW *Polyseal*\* SILICONE RUBBER INSULATION SYSTEM IS AVAILABLE ON CUSTOM '8000' MOTORS

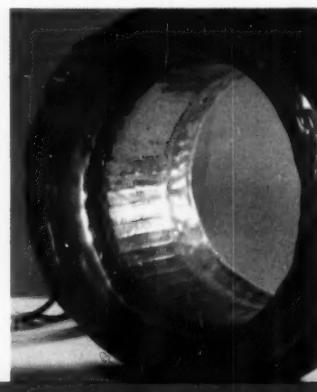
Silicone rubber used in Polyseal insulation systems is a product of General Electric's Silicone Products Dept., Waterford, N. Y. . . a leader in research, development, and manufacture of silicone materials. Supported silicone tape is a development of General Electric's Insulating Materials Dept., Schenectady, N. Y. Com-

bining silicone rubber with dacron-glass supporting materials is a major engineering advancement, giving this material both the mechanical and dielectric strength required for use as a motor insulation. Polyseal insulation systems are available *only* on General Electric motors. Medium AC Motor & Generator Dept.



#### FORM-WOUND MOTORS

Polyseal supported silicone rubber insulation system provides greater mechanical, thermal, voltage and environmental endurance than unsupported silicone rubber. Glass fabric materials are imbedded in each layer of silicone tape, which, after coil wrapping is vulcanized under heat and pressure to seal the system against moisture and contaminants. General Electric form-wound open motors with Polyseal insulation system can be used in some severe atmospheres formerly reserved for totally-enclosed motors.



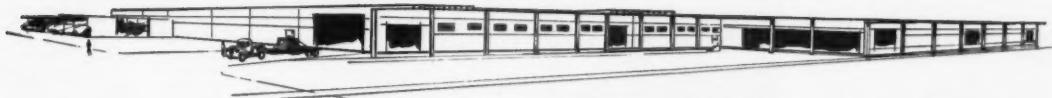
#### RANDOM-WOUND MOTORS

Polyseal silicone insulation system offers greater flexibility and better heat transfer than existing encapsulations . . . it operates effectively from -90C to 200C and will not crack under excess thermal cycling or severe moisture. After receiving G.E.'s standard random-wound insulation treatments, Polyseal insulation is applied to stator and end turns, completely sealing windings with a thin, waterproof, inert covering which protects against extreme moisture, most chemical fumes, dust and corrosion.

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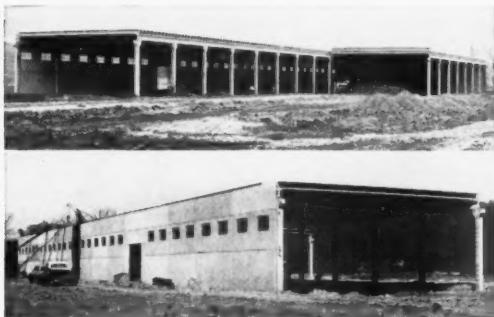
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Perspective drawing of 57,000 sq. ft. manufacturing and warehousing building now being completed at Logan, Ohio, for Metabestos Division, William Wallace Co., Belmont, California. Architect, Richard C. Adams. Structural engineer, Sheng Pao Sheng. Both of Marietta, Ohio. General Contractor, William Loomis & Sons, Logan, Ohio. The Marietta Concrete Corp. designed, fabricated and erected all concrete structural components.

## How Marietta builds a big building in record time



**MARIETTA WORKS FAST.** Crews erect Marietta precast concrete components in a hurry. This section complete with wall panels was enclosed in 2½ days.



**MARIETTA DOUBLE TEE ROOF SLABS AND BEAMS** go up quickly, permit wide, clear spans with more efficient utilization of head room.

Here is an outstanding solution to the problem of economy, beauty and speed in building design and construction. Preliminary design drawings of this \$350,000 building were started March 2, 1959. By April 6, construction was underway with completion scheduled for early June — *just 3 months after design began.*

Marietta precast concrete components make this speedy schedule possible. In addition to simplifying erection, Marietta foundation grade beams, pre-stressed double Tee roof slabs and beams give you these important advantages: low building cost, handsome appearance, maintenance-free service, outstanding fire protection.

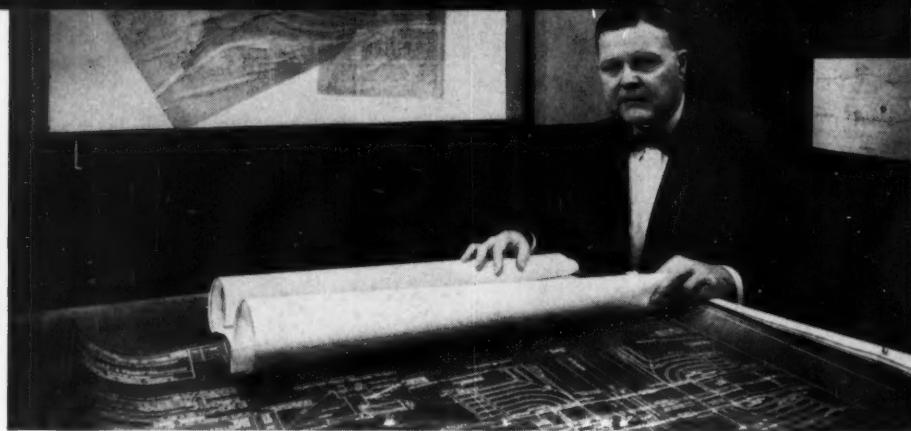
If you are planning a new building, it will pay you to investigate the savings in time and money demonstrated by this job. Marietta will arrange tours of the project for interested persons, handle all details. Just write or call.

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**Mr. Maurice N. Quade, Senior Partner of Parsons, Brinckerhoff, Hall & Macdonald,  
designers of about 50 steel bridges a year.**

**One of the handsome steel bridges on the Prospect Avenue Expressway, Brooklyn, N.Y., designed by Parsons, Brinckerhoff, Hall & Macdonald.**



# Steel is a predominant structural material in short-span bridge work

at Parsons, Brinckerhoff, Hall and Macdonald, Consulting Engineers.

PARSONS, BRINCKERHOFF, HALL & MACDONALD will celebrate their 75th anniversary next year as consulting engineers in the civil engineering field. The scope of their work in the western hemisphere includes highways, bridges, tunnels, municipal and sanitary work, airports, river and harbor work, etc. In the highway field they designed between 50 and 60 short-span bridges in 1958, using rolled steel beams. Currently they have about 50 more on the boards.

Some of the projects include parts of the Bergen-Passiac Counties Interstate Expressway in New Jersey; the Prospect Avenue Expressway in Brooklyn, N.Y.; the Queen Elizabeth Way Connections in Hamilton, Ontario, Canada; the New York State Thruway; Northeast Expressway, Massachusetts.

## Steel is an economical material

Mr. M. N. Quade, Senior Partner of the firm, says that the majority of short-span designs on their drawing boards are composite beam construction,

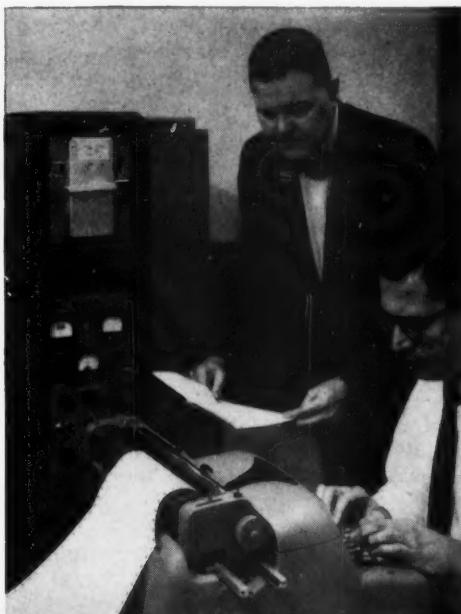
utilizing concrete decks. Combining steel beams with concrete makes it possible to save construction costs. Steel construction goes up fast and saves time and labor. The factors of economy, quick erection and availability all contribute to the fact that steel is a predominant material used in short-span bridge projects.

**Increased facilities.** There is an ever-expanding demand for steel because of its many advantages in the fast-growing market for bridge construction. The steel industry has had the foresight to grow with this vigorous market through greatly expanded facilities for manufacture of structural shapes and plates. You can confidently design in steel—the material you know best, the material that offers most—knowing it will be available.

*USS is a registered trademark*

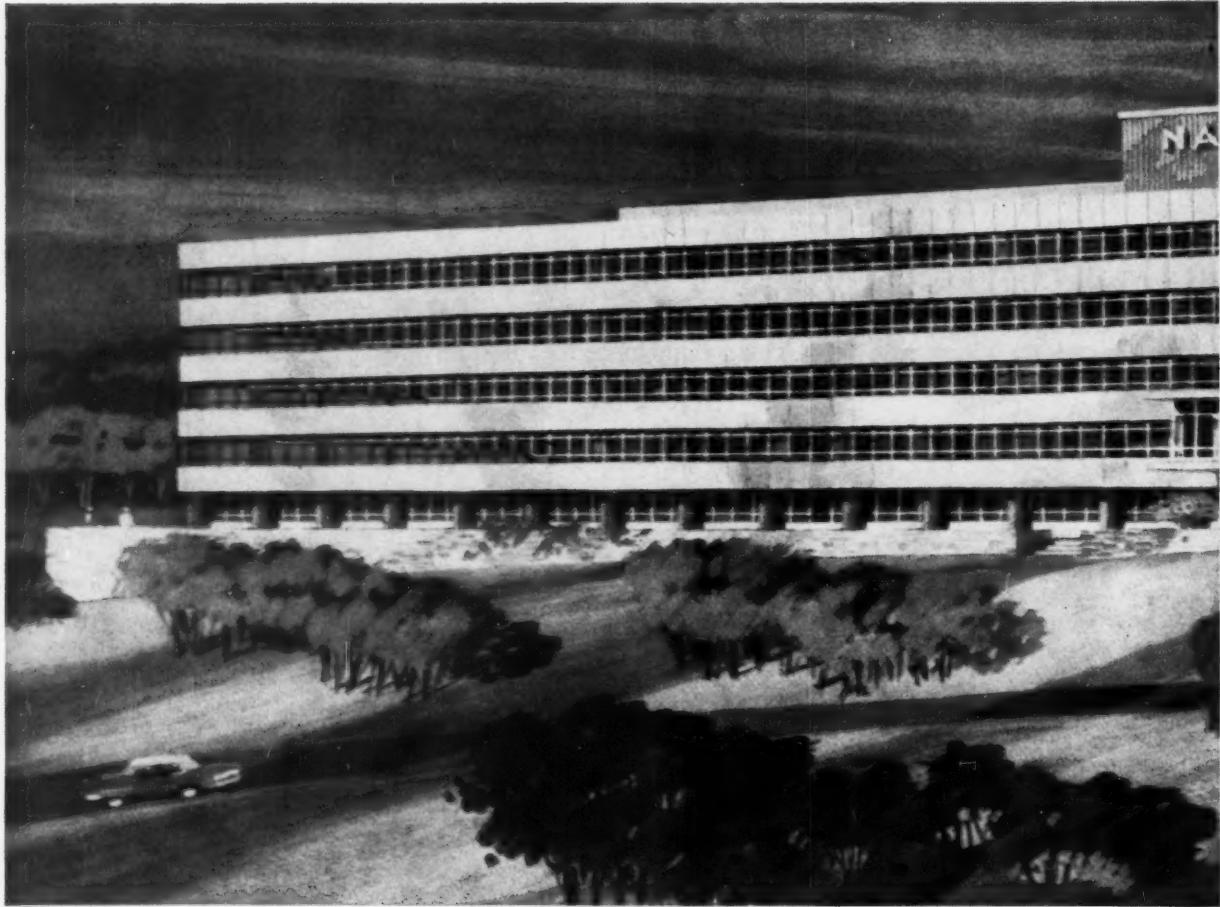
United States Steel Corporation—Pittsburgh  
Columbia-Geneva Steel—San Francisco  
Tennessee Coal & Iron—Fairfield, Alabama  
United States Steel Supply—Steel Service Centers  
United States Steel Export Company

**United States Steel**



Quick erection, low cost, composite beam construction, reduction in traffic delays are a few reasons why structural steel is the predominant material for bridges.

Mr. Quade (left) shown with a new electronic computer system which his company uses to speed up engineering work in composite beam design and in figuring large projects.



## SPANG HEADERDUCT INSURES FLEXIBLE WIRING FOR NATIONAL LIFE



"This combination of SPANG HEADERDUCT and cellular flooring is the most progressive step in electrical wiring distribution in 25 years," states Mr. Santas. "Wiring is carried through the SPANG HEADERDUCT at right angles to floor cells, then runs as needed from the access boxes—one every 18 inches—through the floor cells to where the outlet is required."

National Life Insurance needed the most practical and up-to-date wiring system available for its new office building in Montpelier, Vermont. SPANG HEADERDUCT solved this problem by providing complete flexibility in the location of power, telephone and other communication outlets.

### MOST PROGRESSIVE STEP IN 25 YEARS

Mr. Vern Santas, General Superintendent of the M. B. Foster Electrical Company of Boston, says: "The simplicity, flexibility and installation speed of SPANG HEADERDUCT for wire distribution in connection with cellular floor construction is the most progressive step in the electrical field in 25 years."

### SPANG REPRESENTATIVE TRAINED CREW

"This was our first SPANG HEADERDUCT installation," continues Mr. Santas, "so a SPANG representative trained my crew. We are now proficient in this type of installation and expect to use SPANG HEADERDUCT on new bids."

### SPANG HEADERDUCT DESIGNED FOR FAST, EASY INSTALLATION

All component parts of SPANG HEADERDUCT are designed to eliminate as much fabrication time at the job site as possible. Coupling headerduct sections is fast. Corner leveling screws on access boxes bring boxes accurately to screed level without the use of a surveyor's transit. And square openings on access boxes give more working room for splicing wires and making future wiring changes after concrete is laid.

### WRITE FOR MORE INFORMATION

See how easy it is to make a SPANG HEADERDUCT installation; write for your free copy of the booklet, *How to Install Spang Headerduct*.



**Architect:** Hoyle, Doran & Berry, Boston, Massachusetts  
**Electrical Engineer:** Thompson Engineering Company, Inc., Boston, Massachusetts  
**Electrical Contractor:** M. B. Foster Electrical Company, Boston, Massachusetts  
**SPANG Distributor:** Wesco, Burlington, Vermont



Mr. Tewksbury and Mr. Morse, Foremen for M. B. Foster Electrical Company, discuss the ease of working inside square access boxes after concrete is laid. Square design provides more room for making splices. Access boxes are quickly brought to screed level by adjusting corner leveling screws.



Electrical crew installs SPANG HEADERDUCT at National Life job. Left to right: first man cuts through headerduct and into cellular floor with circular saw; next two men apply protective grommet around the opening with a hydraulic tool; workman on far right welds headerduct to flooring.



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# Atoms in Action

JOHN F. LEE

Broughton Professor and Head  
Department of Mechanical Engineering  
North Carolina State College

## IBRD Nuclear Power Study

**COMMERCIAL NUCLEAR POWER** is the subject of a recent publication by the World Bank (International Bank for Reconstruction and Development). It summarizes the report of an international panel of experts appointed by the Bank to study the feasibility of such a project for southern Italy. Results of this localized study carry important implications for nuclear power projects anywhere.

Known as Project ENSI, the study sought to:

- ¶ Provide firm data on relative costs of competing nuclear power plants by inviting proposals from firms on a competitive and international basis
- ¶ Evaluate the facts substantiated by firm proposals as a sound basis for selecting the optimum type of nuclear power plant
- ¶ Ascertain from the facts the actual cost of a nuclear power plant relative to a conventional thermal power plant of the same capacity

The first phase of the study was conducted in a most unusual and interesting fashion. In the invitations to bid, the type of reactor was left open, thus permitting each bidder to propose whatever design of nuclear power plant he believed best. The bidder was required to submit a firm price with warranties on output and performance.

A further objective was to introduce, to the extent feasible, the concept of competitive international bidding, in the belief that such competition would result in closer estimating of costs by the bidders and thus lead to lower power and equipment costs. It was recognized that if one type of reactor were chosen in advance and the invitation to bid built around the technical specifications of that particular reactor, the feature of international competition would be missing. For example, most

firms in the United States probably would bid only enriched reactors. Firms in the United Kingdom and France undoubtedly would bid natural uranium gas-cooled reactors.

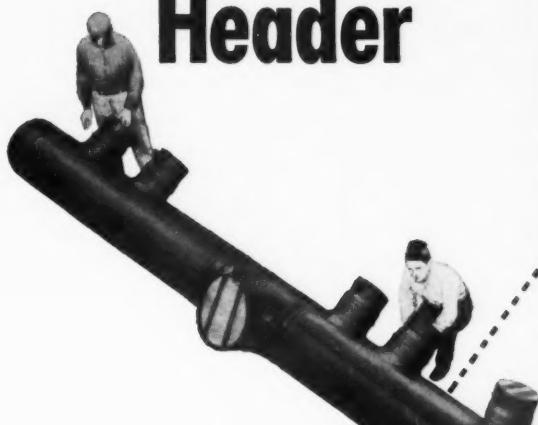
The invitation to bid was sent to 17 firms that had indicated an interest in developing a nuclear power plant, with a capacity of 130,000-150,000 kilowatts, that could be completed in approximately four years. On the closing date, nine firms had submitted proposals: A.E.I. John Thompson Nuclear Energy Co., Ltd., London; Atomics International, Los Angeles; G.E.C. Simon Carves Atomic Energy Group, Kent; H. K. Ferguson Company, New York; International General Electric Co., New York; Kaiser Engineers, Oakland; Mitchell Engineering Co., Ltd., London; Société Générale de Constructions Électriques et Mécaniques, Paris; and The English Electric Co., Ltd., Stafford.

Upon receipt of the nine proposals an evaluation of the facts, substantiated by the proposals, was begun. In addition to the nine proposals the following technical information was available:

- ¶ A review of four gas-cooled natural uranium reactors prepared by the Atomic Energy Authority of the United Kingdom
- ¶ Five reviews of enriched uranium reactors prepared by Argonne National Laboratory, and the bidders' comments on the reviews
- ¶ A tabulation of design features prepared by the study group
- ¶ Estimates of construction costs prepared by the study group.

The nine proposals covered four basic reactors: gas-cooled, natural uranium, graphite-moderated, and enriched reactors. The enriched reactors in-

# 6 Ton Hot Reheat Header



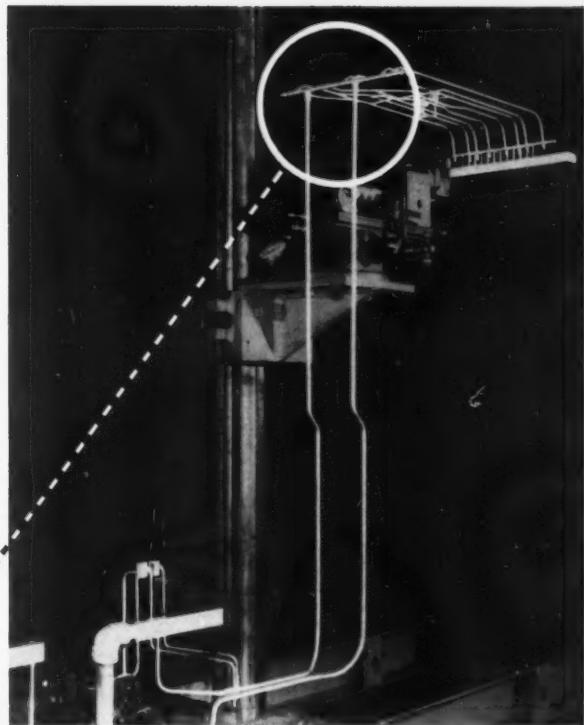
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The inset shows the position and relative size of the header in the line, and the main illustration is an actual photograph of this header as fabricated in our shops. The complete system, which includes chrome-moly and stainless



Model test set-up of hot reheat line as reproduced above is approximately 1/10th actual size of the model. Circled area shows position of chrome-moly header in the line.



Size of this hot reheat header can be seen by comparison with men in the picture. It is 21" O.D., fabricated of 2 1/4% chrome, 1% molybdenum steel.

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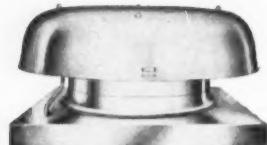
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cluded pressurized-water, boiling-water, and organic-moderated reactors. No proposal was rejected as impracticable.

In appraising the technical characteristics, the panel categorized the features of the proposed reactors in three groups: all features satisfactorily established; important features not yet fully developed; and features requiring continuing development. Regardless of economic comparisons, all reactors displayed technical uncertainties. These uncertainties then were reviewed under two broad classifications of reactors.

### Natural Uranium Gas-Cooled Reactors

Four of the proposed reactors can be described as natural uranium gas-cooled reactors. The four plants offered in this category were generally similar to installations already under construction in the United Kingdom and France. A general characteristic, and advantage, of this type of system is the low fueling cost, which tends to counterbalance the high capital cost when compared to enriched systems. Indeed, for three of the gas-cooled systems proposed, the fuel costs were in the neighborhood of three mills and differed from each other by only a few tenths of a mill.

One of the four proposals differed appreciably from the others. This design, because of conservative maximum burnup, higher cost fuel elements, and lower thermal efficiency, involved higher fueling costs — of the same magnitude as would be expected in enriched systems. However, the capital cost for this particular reactor was actually lower than the capital cost of two of the other reactors with lower fueling costs.

The reactor with the lowest fueling costs also was distinguished in its design by the attention given to minimizing capital costs. The over-all cost comparison showed this particular reactor to be competitive with the most attractive of the enriched systems that were proposed.

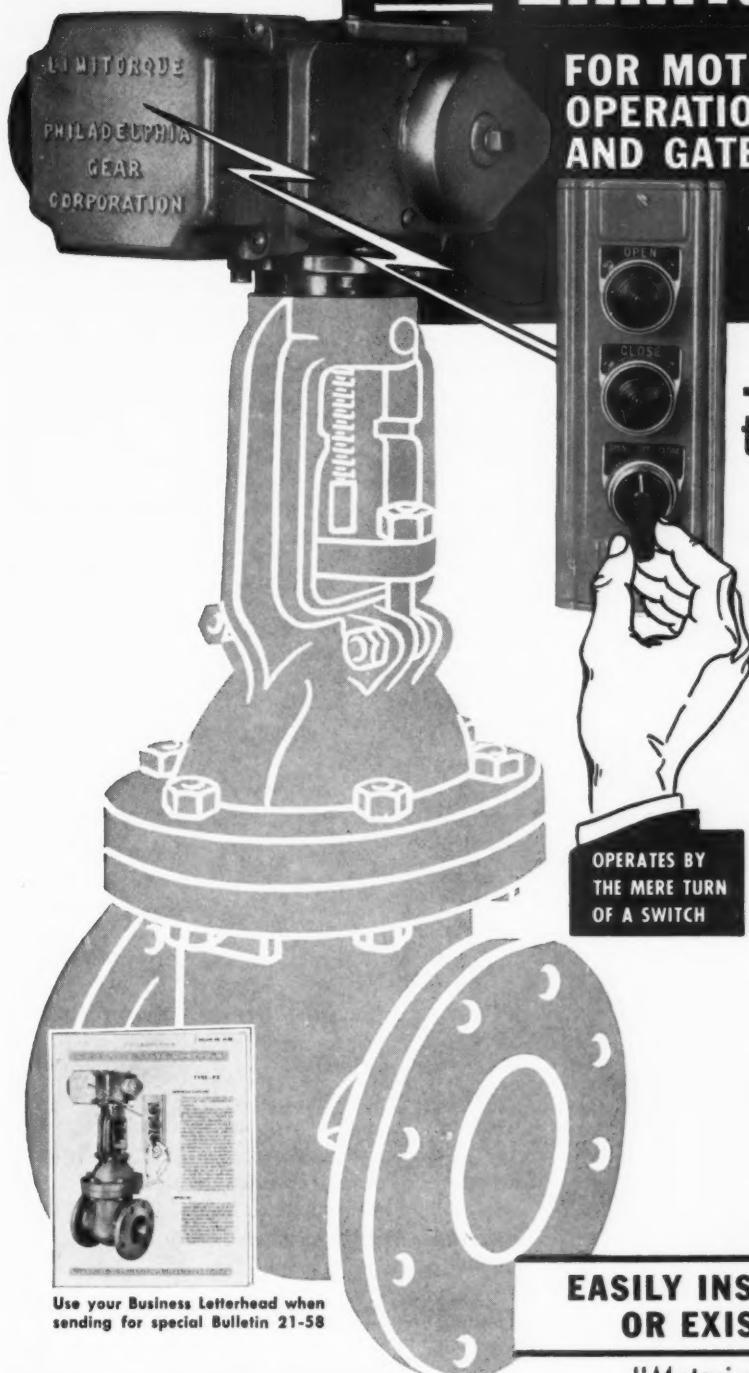
In general, the charge-discharge machines were deemed to have an adequate capacity for normal operation, but the capacities of some were not sufficiently great to avoid the discharge of a considerable amount of fuel at relatively low burnup while the reactor is brought into equilibrium. One design incorporated a novel type of machine which was located underneath instead of above the reactor. The arrangement proposed has several advantages. The more rapid operation of the machine permits speedy recharging as well as axial and radial shuffling of the fuel. This makes possible the attainment of a higher average irradiation of the fuel, especially during the early years of reactor operation before equilibrium has been established. A second advantage is that refueling operations

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need not interfere with routine maintenance of the control rod mechanisms from the top of the reactor. A third advantage is the accessibility of both ends of the fuel channel for servicing if difficulties arise in particular channels in the reactor core.

The main uncertainty about this charge machine operating from below is its complex design. No model has as yet been in service, and it appears that an extensive development effort will be required before a machine of the requisite high degree of dependability is available. Most of the other designs were based upon machines incorporated in reactors under construction, and it was felt that initial operating difficulties probably would be overcome before the station would be completed.

Designs of fuel element assemblies were examined and generally were regarded as satisfactory and operable within the claimed maximum temperatures. Various support structures were proposed, but in at least one instance there appeared to be a possibility that bowing of the fuel elements would complicate axial or radial shuffling processes.

Two of the bids proposed a hollow-tube uranium fuel element which, on the basis of general considerations, gave indications of higher power output and higher burnup than solid-rod fuel elements. However, there is no history of practical operating experience with such elements, and the estimates of reactivity and metallurgical limitations were more uncertain than for fuel elements with a longer record of operational experience. A substantial test program for irradiation of hollow fuel elements is under way in the United Kingdom, since it is intended to use them in future power plants.

When a reactor is restricted to the use of natural uranium, errors in estimating reactivity have a much greater effect on reactor performance than in a reactor fueled with slightly enriched uranium where changes in enrichment are possible. Based upon information provided by the United Kingdom Atomic Energy Authority, the panel calculated the following uncertainties:

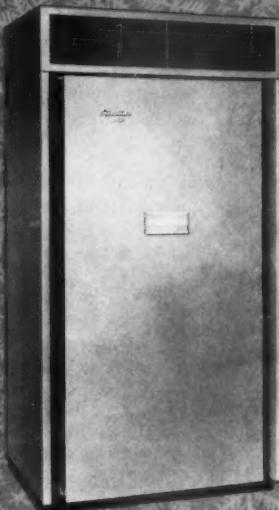
Uncertainty in reactivity of unirradiated fuel (90% confidence level) .....	±0.5%
Uncertainty in change of reactivity during irradiation (90% confidence level) ...	±0.6%
Margin on reactivity allowed by bidder in predicting reactivity lifetime of fuel .....	±0.5%
Poisoning by thermocouples, not allowed for in design .....	±0.25%
Change in reactivity due to proposed increase in moderator temperature:	

Unirradiated fuel .....	-0.6%
Equilibrium fuel .....	+0.6%

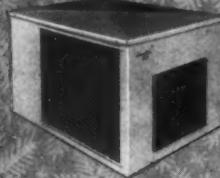
Some of the original control systems proposed by the bidders were not considered satisfactory,

# Curtis

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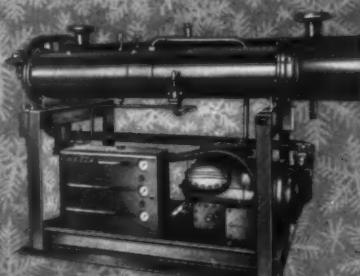


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# Curtis

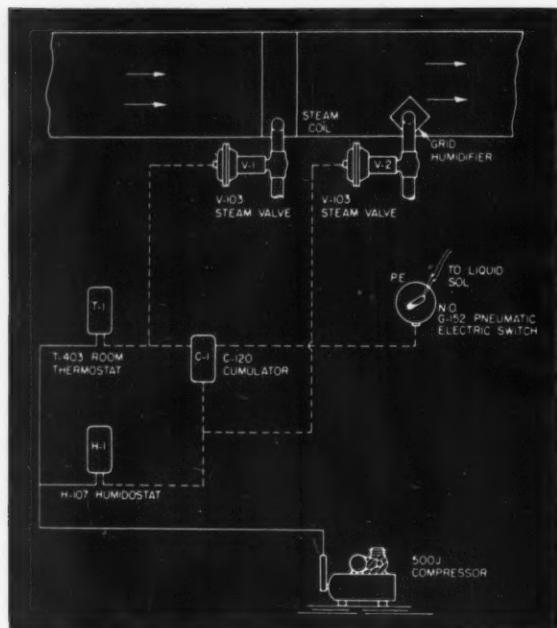
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though in one instance a supplementary submission and clarification promised to overcome the original difficulty. For several reactors possible asymmetric instabilities in flux required, in the view of the panel, appropriate modifications of the control mechanisms. There was little doubt that these modifications could be made without encountering a great deal of difficulty.

### Enriched Uranium Systems

Five proposals were submitted covering enriched uranium systems. Two were based on pressurized-water reactor systems and were similar in many respects to reactors already being built in the United States by the bidders. Two others incorporated boiling-water reactors, which represent an extension of the pressurized-water concept to the extent that steam generated directly in the reactor core is utilized to drive a turbine without the use of an intermediate heat exchanger. One of these is closely similar to a plant being built in the United States by the bidder. The other was characterized by two independent boiling-water reactors, a concept that would have had considerable attraction had it not involved a comparatively high capital cost per installed kilowatt. The fifth bid involved organic moderation.

A significant feature of three of the four water systems was the poor neutron economy resulting from the use of stainless steel as cladding material for the fuel elements. In the fourth proposal, low-neutron-absorbing zircaloy was to be used for fuel cladding, allowing this reactor to use uranium less enriched in U-235 than the other three proposed. Use of uranium oxide fuel permits it to receive, without excessive radiation damage, much higher exposures than is possible in reactors fueled with metallic uranium. In one reactor, replacement of one-fifth of the fuel charge at a time, together with a shuffling of the remaining fuel elements, provides more nearly uniform exposure of fuel than does the replacement of the entire fuel charge at one time, as proposed in some of the other water systems.

### Achieving Better Fuel Costs

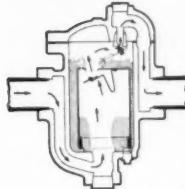
Flattening of the flux distribution throughout the reactor is an important factor toward attaining higher burnup. This, in turn, leads to more attractive fuel costs. For one of the pressurized-water reactors flux flattening seemed to be satisfactorily achievable by enrichment of the outer zones. For the other, the flux distribution had a higher maximum-to-average ratio, and this was considered detrimental to a long irradiation lifetime of the reactor system fuel.

Consideration of all these aspects of efficiency of fuel utilization gave one of the boiling-water

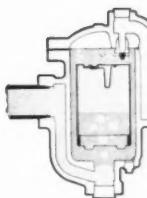
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Armstrong O.F.&T. Traps make it possible for heating systems to deliver the efficiency they were designed to deliver. They are ideal for low pressure unit heaters, pipe coils and standing radiation.

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**UNCONDITIONALLY GUARANTEED**—All Armstrong Traps are guaranteed to satisfy the user or purchase price will be refunded.

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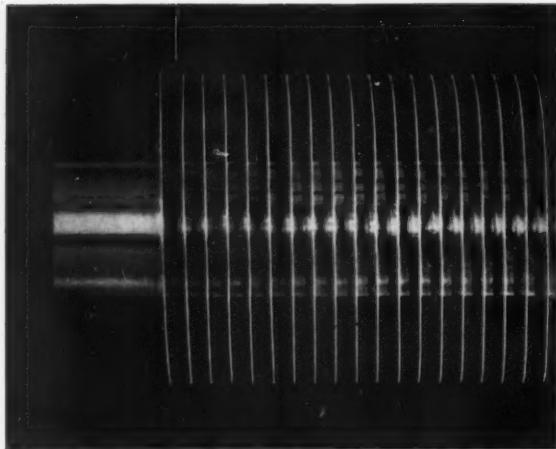
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## **AEROFIN Smooth-Fin Coils offer you**

**Greater Heat Transfer  
per sq. ft. of face area**

**Lower Airway  
Resistance  
—less power per c.f.m.**

Aerofin smooth fins can be spaced as closely as 14 per inch with low air friction. Consequently, the heat-exchange capacity per square foot of face area is extremely high, and the use of high air velocities entirely practical. Tapered fin construction provides ample tube-contact surface so that the entire fin becomes effective transfer surface. Standardized encased units arranged for simple, quick, economical installation.



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reactors a significantly lower fuel-cycle than any of the other water systems analyzed in the study.

### **Coolant System Contamination**

Experience with the water-moderated reactors has shown that the coolant system may become contaminated with radioactive cobalt, which is difficult to remove. Stainless steel was specified in one reactor for control rods, fuel assembly supports, thermal shield, vessel liner, and the first set of fuel channels. Three other reactors utilized large quantities of stainless steel as fuel cladding. Neutron irradiation may produce radioactive 70-day cobalt-58 by fast neutrons from nickel (Ni-58) in the stainless steel and 5.2-year cobalt-60 from cobalt present as an impurity in the nickel or by fast neutrons from the isotope nickel-60 which forms 26 percent of natural nickel.

Although less stainless steel was to be used in one of the boiling-water reactors than in the other water-moderated reactors considered, cobalt contamination of the turbine might be quite troublesome. Experience with stainless steel in other boiling-water reactors will indicate how serious this problem is. Measures which could be taken to reduce the extent of cobalt contamination include use of cobalt-free stainless steel, and substitution of other materials for stainless steel in the initial set of fuel channels and elsewhere in the reactor.

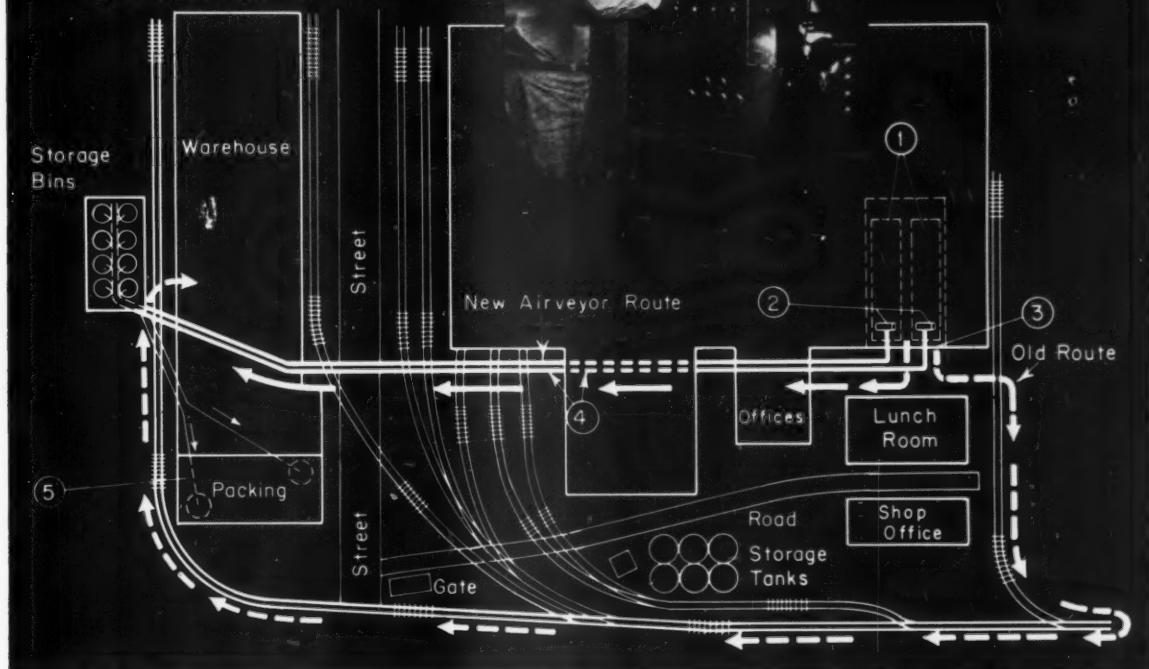
The use of stainless steel in pressurized-water reactors probably would result in some radioactive cobalt being distributed through the primary circuit. However, this was not regarded as a serious problem in a pressurized-water reactor where no coolant from the primary circuit enters the turbine.

### **Organic-Moderated Systems**

The organic-moderated reactor, the basis of one proposal, is a promising concept. At this stage, the design is based upon operation of the Organic-Moderated Reactor Experiment at the National Reactor Testing Station in Idaho. While the proposal does not as yet show sufficient economic advantages to offset the technical uncertainties associated with its present incomplete stage of development, the concept does warrant further study. Advantages include the use of a low-pressure noncorrosive coolant and its correspondingly low capital cost. On the other hand, the radiation decomposition of the organic coolant and moderator will add to the operating costs. More information on long-term decomposition rates and effects is desirable.

The proposed fuel element design gave fuel costs which, while less than those of some of the reactors, were still not competitive with several others. A number of different fuel element designs were mentioned in this proposal, but none of these were fully

- 1 Two 10,000 lb. per hour starch driers.
- 2 Two Airveyors pump dried starch to storage bins.
- 3 Starch was bagged here and taken over old route to storage.
- 4 New Airveyor route is direct; passes through or over obstructions.
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PLANT MODERNIZATION THROUGH PNEUMATIC CONVEYING

## FULLER pneumatic conveying system increases production without plant expansion

To increase production, the Union Starch and Refining Company's Granite City, Ill., plant first needed to expand their materials handling system. But a complete revamping of bagging and warehouse operations was impossible because there was no space available for necessary new buildings.

An Airveyor® System, engineered and built by Fuller, was the answer. Airveyor's extreme flexibility allowed it to be set up through walls, along sides of buildings, over streets, on roofs and up inclines. At Union Starch, the total

distance covered is 800 feet, with a number of 45 degree and 90 degree bends in the line.

The Fuller Airveyor system transports the starch in two phases, from the driers to the storage bins and from the bins to receiving hoppers over the bagging machines. Flow is controlled automatically through control panels located in the drier room and at the bagging machines. Other controls are also provided at the panels for automatic operation of components such as feeders,

blowers, conveyors and filter-receivers. Besides being easily installed and automatically controlled, the Fuller system reduces both the amount and the expense of handling. Additional savings are made possible by Airveyor's self-cleaning facility, which greatly reduces maintenance costs.

Why not work with Fuller to design an automated pneumatic materials handling system that will help you cut costs and increase production? Write today for complete details.

A-280  
1355



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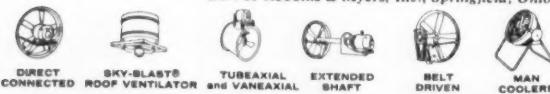
Move corrosive or explosive fumes, extreme heat or high humidity with new PROPELLAIR Type BT belt driven axial fans. They feature heavy 10 and 12-gage drums . . . isolated, air-cooled, protected bearings and belts . . . airfoil propellers cast of hi-strength aluminum-magnesium alloy . . . Robbins & Myers "All-Weather" motors for a single nameplate guarantee on the complete unit.

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engineered. The panel believed that the performance of this reactor could be improved markedly through the use of an oxide fuel element with higher burnup than could be achieved with metallic fuel.

### Economic Analysis

The cost analysis revealed that only two the enriched fuel reactors promise equilibrium fueling costs below 6 mills/kwh, and that it was unlikely that those above 6 mills/kwh could be brought below this figure without substantial engineering changes in the proposal. The high costs resulted from poor neutron economy and restrictions on fuel handling which were inherent in the designs.

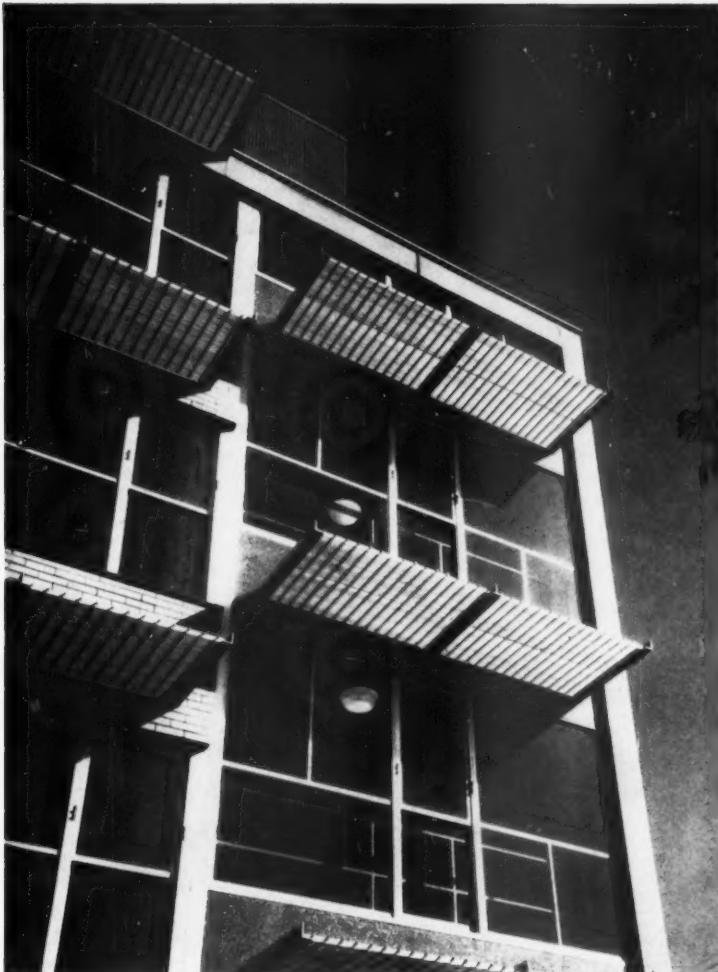
All the gas-cooled reactors gave fueling costs below 6 mills/kwh, but it was realized that the equilibrium assumed would be reached slowly and in some instances the proposed fueling scheme involved higher initial charges. By special procedure, one of the gas-cooled reactors arrived at lower initial fueling charges. These would rise, but only after several years, to the equilibrium value. Thus, this reactor possesses a cost advantage beyond that revealed by the analysis. Conversely, one of the other gas-cooled reactors showed a relatively high fuel cost, and the panel's technical appraisal of that reactor indicated that some cost reduction could in all probability be developed.

The cost analysis showed that the proposed power costs cover approximately the same range (11 to 17 mills/kwh) for the gas-cooled reactors as for the enriched uranium reactors. In the main, however, the range of capital costs is responsible for the variation for the gas-cooled reactors whereas the differences of fueling costs account for most of the spread for the enriched uranium reactors.

The difference between the lowest costs of power for reactors of the two types is not significant in view of the uncertainties involved in the analysis and the allowance for contingencies that should be added. From this analysis, two plants, one utilizing natural uranium and the other enriched uranium, appeared to deserve closer study because of their prospective low costs.

### Fuel Cost Differences

Other detailed studies of the bids were made. They served to show that, over the first few years, significant differences would arise in fueling costs among the different reactors. These were evaluated carefully for three proposals, the two which appeared to deserve closer study based on the earlier analysis, and one other because of its radically different fueling procedure. This later analysis underlined that the differences in costs are not associated with the reactor type so much as with the fueling method proposed for a particular design.



★ Curtis Hall, Temple University, Philadelphia  
Nolen & Swinburne, Architects

SUNSHADES of standard panels of IRVICO aluminum grating reduce cooling costs and add handsome "transparent" appearance to this four-story classroom building. The open mesh won't trap hot air next to glass. Grating panels are strong enough to be used as window cleaning walkways. They provide a permanent, practical solution to the problem of sun control.

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Grating is clean and simple. It gives practical advantages without sacrifice to good looks. In many cases it enhances the architectural effect.



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HAS GIVEN  
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of  
Michigan  
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Vestibule mats of Irving grating prevent excessive grit, mud and wetness from being tracked into corridors. Grit, rain, snow and slush drop through the open-mesh grating to receptacles below which can then be flushed into sewers. Thus a clean entrance is always assured, and the cleanliness of the interior is in turn preserved.

## CONCRETE PERFORMANCE REPORT

### Pozzolith concrete employed in new Air Force Academy to meet full range of engineering requirements for all types of concrete specified

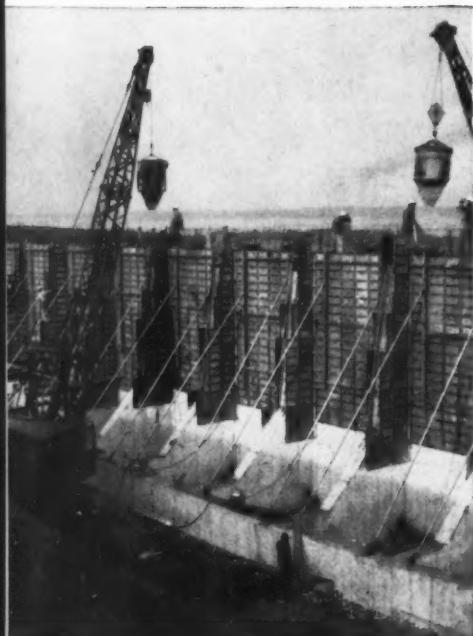
Largest single construction project in U. S. Air Force history, the Air Force Academy Complex at Colorado Springs marks a milestone in modern concrete design and construction. Nearly 95% of the \$114 million allocated for "pure construction" has gone into nearly 70 major building contracts—including over 4 million square feet of enclosed floor area. Construction at the 17,900 acre Academy site included the placing of some 800,000 cubic yards of concrete for buildings, retaining walls and bridges.

**On-site concrete control lab**—The Air Force Academy Construction Agency and the architects—Skidmore, Owings, and Merrill—jointly supervised all construction and established an on-site concrete materials control laboratory early in 1956. During July and August, 1956—with only a few thousand yards of concrete placed—they observed erratic and low compressive concrete strengths. The wide range and rapid changes in temperature were suspected as the cause.

free fall of the concrete to 5 feet—maximum permitted by specifications. The mix was easily vibrated into place with no segregation or honeycomb. Retaining walls required approximately 24,000 cubic yards of concrete—supplied by a job site batch plant and delivered in ready-mix trucks. This mix met strength specifications and provided necessary workability for proper placement in the heavily reinforced, narrow forms.

**Prestressed bridge girders**—Construction work also included the

# AIR FORCE



**CONCRETE RETAINING WALLS** reach 36 feet high over much of the 10,000 foot wall length. Tallest pours were made by giant overhead crane. Walls required approximately 24,000 cubic yards of Pozzolith concrete—a placeable mix of 2" to 4" slump with design strength of 3,000 psi. Contractor: T. F. Scholes, Inc., Reading, Pennsylvania. Concrete Contractor: Long Construction Co., Denver.

**Evaluation tests of concrete materials**—In August, they engaged Commercial Testing Laboratories, Denver, to make comprehensive tests. Their tests clearly established that POZZOLITH would provide uniform, high strength throughout the wide range of temperature changes experienced between early morning concreting at about 50°F and mid-day concreting at 75° to 80°F. In September 1956, POZZOLITH was first employed in concrete at the Academy. Its successful performance here led the engineers to investigate the use of POZZOLITH for control of other classes of concrete—including lightweight aggregate concrete, prestressed concrete and structural concrete. *As a result of this investigation, POZZOLITH and only POZZOLITH was used as the water-reducing, set-controlling admixture for the project.*

**2-mile retaining wall**—Concurrent with concreting of foundation caissons, work began on 10,000 feet of concrete retaining wall that reached a height of 36 feet over much of its length.

Design strength of the concrete required here was 3,000 psi at 28 days. With 1½" top size aggregate, 5 bags of cement, 36 gallons of water and POZZOLITH—a placeable mix of 2" to 4" slump was obtained that readily exceeded the 3,000 psi specification. Tremie trunks were used to limit the

erection of six prestressed bridges varying in length from 144 to 600 feet. There were two railway spans and four highway bridges—their girders standardized at 120 feet long in a modified T design, 7½" deep. In all, 128 girders were manufactured. Sixteen shorter girders were erected for the two railroad bridges each of which consists of two simple supported spans of 72 feet each.

Concrete for these girders contained 7½ sacks of Type I cement, 1760 lbs. coarse aggregate (¾" top size), 1300 lbs. sand, 30.5 gallons of water and POZZOLITH Retarder.

This produced a cohesive, workable mix of about 2" slump and 4% entrained air. The POZZOLITH Retarder provided an initial retardation which permitted proper consolidation of the mix, yet accelerated early strength. Specifications called for a compressive strength of 4,500 psi before application of stress. This strength was achieved in three to five days, air cured. Stress was applied at that time. Concrete attained a compressive strength of approximately 6,500 psi in 7 days and well over 7,000 psi in 28 days.

**Concreting bridge decks**—Initial retardation was required in the concrete bridge decks to provide an initial delay in hardening so that the complete deck for each span could be completely



**AERIAL VIEW** of nearly completed Air Force Academy. Construction under supervision of the Air Force Academy Construction Agency. Architects: Skidmore, Owings & Merrill, Chicago. Contractors include: Jack Adams & Haake Construction Co., Santa Fe, New Mexico • B. H. Baker Co., Inc., Colorado Springs • J. W. Bateson Co., Inc., Dallas • T. C. Bateson Construction Co., Dallas • A. H. Beck Foundation Co., San Antonio • Colorado Constructors, Inc., Denver • Dondlinger & Sons Construction Co., Inc., Wichita • E. & M. Construction Co., Denver • Elgar Construction Co., Colorado Springs • Farnsworth & Chambers Co., Inc., Houston • A. S. Horner Construction Co., Denver • Peter Kiewit & Sons Co., Denver • Wade Lahar Construction Co., Tulsa & Denver • Long Construction Co., Denver • Matelich & Hanson, Inc., Englewood, Colorado • Robert E. McKee, Inc., Santa Fe, New Mexico • Mountain States Construction Co., Denver • Nowers Construction Co., Pueblo, Colorado • Frederick Raff Co., Colorado Springs • Ramsey-Leftwich, Lubbock • Saxon Foundation Co., San Antonio • T. F. Scholes, Inc., Reading, Pa. • Del E. Webb & Rubenstein Construction Companies, Phoenix • J. F. White Engineering Co., Englewood, Colorado • POZZOLITH Ready-Mixed Concrete: Concrete Materials, Inc., Kansas City • General Concrete Co., Colorado Springs • Transit Mix Concrete Co., Colorado Springs.

# ACADEMY

poured before initial set occurred. This permitted full dead load deflection and achieved true composite action between girders and the concrete deck. Because the contractor wanted to use the completed decks as work areas in placing girders for the remaining spans, it was important that these slabs be placed into service at an early date. POZZOLITH Retarder provided the required, controlled initial delay in hardening and produced early strengths equal or better to what could be expected with a comparable plain concrete mix. At placing temperatures below 50°F, no extended delay in hardening occurred.

**Lightweight concrete**—Design of many of the buildings included lightweight aggregate concrete floors for the second, third and fourth stories—and concrete roofs. Preliminary mix designs indicated that with local light-

weight coarse aggregates, natural sand for most of the fine aggregate and POZZOLITH—the 3,000 psi compressive strength specification could be met with 5 sacks of cement and air content maintained at  $9\% \pm 1\frac{1}{2}\%$ . This lightweight concrete had excellent workability and weighed approximately 105 lbs. per cubic foot, well below the 110 lb. maximum specified.

**POZZOLITH and Master Builders field service**—POZZOLITH was an important aid in meeting and exceeding specification requirements in over 750,000 of the 800,000 cubic yards of concrete at the Air Force Academy. For each of the many classes and types of concrete specified—it provided the required batch-to-batch uniformity, most

*The Master Builders Company, Cleveland 3, Ohio • Division of American-Marietta Company  
The Master Builders Company, Ltd., Toronto 9, Ontario • International Sales Department,  
New York 17, New York • Branch Offices in all principal cities.*

economically, for the broad range of job requirements and varied climatic conditions encountered at the site.

The Master Builders field men and the Company engineering staff worked closely with project engineers, the field control laboratory, contractors, and concrete suppliers to achieve the common goal of uniform, superior quality concrete at lowest cost-in-place.

For your job . . . with your materials POZZOLITH concrete is best. Neither plain concrete nor concrete with any other admixture can match the results you obtain with today's POZZOLITH.

On any current or future concrete projects, the local Master Builders field man will welcome discussing your requirements. Call him in. He's at your service—and expertly assisted by the Master Builders research and engineering staff—unexcelled in the field of concrete technology. Write us for complete information.



**PRESTRESSED CONCRETE BRIDGE GIRDERS** attained 28-day compressive strength of over 7,000 psi. Construction of all 144 POZZOLITH girders was by A. S. Horner Construction Co., Contractors, Denver. Consulting Engineer: L. Boduroff, Denver. Prestressing: Prescon Corp., Corpus Christi, Texas.

# MASTER BUILDERS. POZZOLITH®

\*POZZOLITH is a registered trademark of The Master Builders Co. for its concrete admixture to reduce water and control entrainment of air and rate of hardening.

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## **THIS NEW 1,520,000-SQ. FT. PLANT\* REPLACES 17 MULTI-STORY BUILDINGS!**

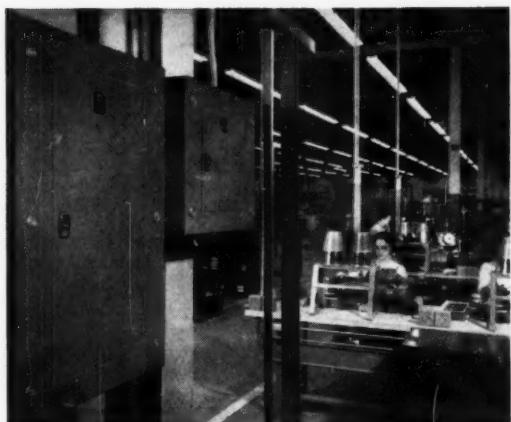
Automatic Electric Company's new plant at Northlake, Illinois, is an outstanding example of more capacity per square foot through straight-line production design. Specifically, production capacity has been increased approximately 100%—and with only 25% more floor space!

Square D electrical distribution and control equipment plays an important part in many key operations of this beautiful, highly efficient new plant.

\*Designed and built by The Austin Company

**FIELD ENGINEERING SERVICE** is available to architects and consulting engineers through more than 100 Square D offices, backed by 1000 authorized electrical distributors and 19 plants in the United States, Canada, Mexico and Great Britain

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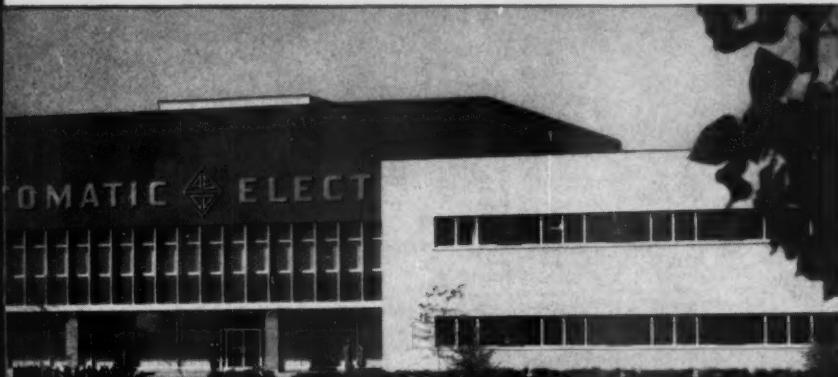
Scientific lighting prevails throughout the factory and office areas. Square D lighting panelboards are used exclusively. Shown above are two of hundreds installed in every part of the plant.



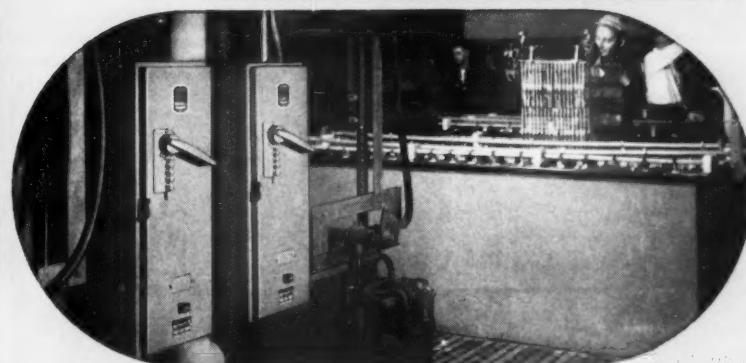
**EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE**

**SQUARE D COMPANY**

# electricity is distributed and controlled



Good example of space saving—this Square D substation is a mezzanine installation, thus releasing many square feet of valuable "main floor" space.



Here are Square D combination starters on duty in the plating department:  
There are hundreds of them serving dozens of departments.

## A *Complete* LINE OF ELECTRICAL DISTRIBUTION AND CONTROL EQUIPMENT

ADJUSTABLE SPEED DRIVES  
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LAUNDRY CONTROL  
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# News for the Consultant

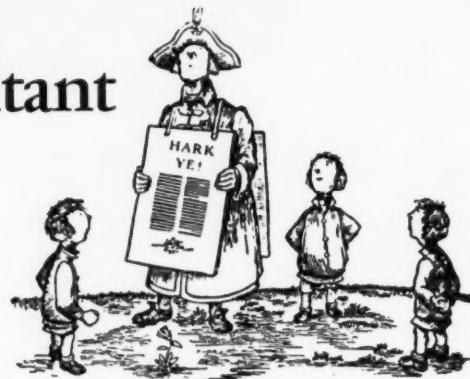
## Concrete Radiation Shield

The economics of hot cell shielding for a commercial enterprise is extremely complicated. It follows, that a comprehensive engineering study preceded the Picker X-Ray Company's decision to use poured concrete as a shield on their new research cell located in Cleveland. It is the first installation of its kind using normal concrete.

The Picker cell is 6-ft square on the inside, surrounded by 5-ft concrete walls and 4-ft thick concrete floor and ceiling. These thicknesses are sufficient to contain the largest radiation sources available with complete safety. A total of 271 cubic yards of reinforced concrete surrounds the cell, amounting to 1,140,000 lbs of concrete for shielding. Total cost in place was \$12,100.

Initial concrete specifications prepared by McGeorge-Hargett and Associates, Consulting Engineers, called for 3000-psi concrete weighing a minimum of 150 lbs per cu ft. As a water reducing agent, 0.25 lb of Master Builders Company normal Pozzolith was specified. This effectively increased unit weight of the mix for better shielding and at the same time reduced the possibility of cracking due to heat generation and shrinkage stresses.

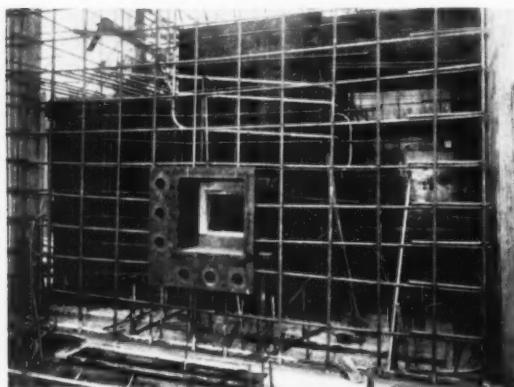
A preliminary mix of local materials was proportioned by Herron Testing Laboratories. It included 517 lbs of Type I portland cement, 1475 lbs of Pelee Island sand, 1900 lbs of coarse #4 dolomite



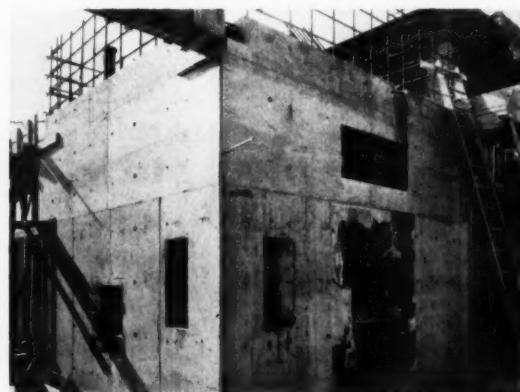
crushed stone, and 38.5 gallons of water per cubic yard of concrete. The water reduction obtained with the admixture allowed an additional 140 lbs of dolomite per cubic yard. This mix weighed 155.4 lbs per cubic foot.

An 18-in. test wall poured with this mix showed an accelerated set which clearly indicated that in the 66-in. thick walls of the hot cell, thermal cracking and shrinkage stresses could be expected to develop. Working with Master Builders, a second mix was developed which incorporated a Pozzolith retarder. This met requirements, but set too rapidly to permit adequate detrainment of air. A third effort, with the addition of an air detraining agent solved the problem. It produced a slump of an easily placeable 4½ inches and met the density specifications with less than 1 percent air. In fact, this final mix was so workable that the contractor chose to use it for the entire south half of the second floor of the building.

The cell itself is a three-story structure containing nearly 300 cubic yards of concrete, weighing al-



Reinforcing bars surround steel shell for hot cell before 66-in. thick concrete walls are poured.



Special mix left no honeycombing or cracks when forms were stripped from concrete after seven days.

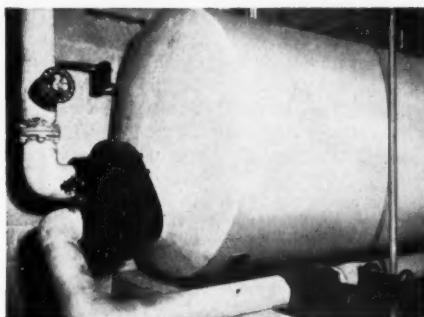
Where quality counts . . .

# Specify RECO



General Contractor: Atlantic Construction & Engineering Co.; Mechanical Contractor, Cross Plumbing Co., Ft. Lauderdale; Engineers, Oboler & Clarke; Architects, Gibbs & McKay; RECO Representative, Essex Heating & Air Conditioning, Miami.

## TWO RECO CEMENT-LINED HEATERS SERVE NEW GALT OCEAN MILE HOTEL



From window glass to heating system, *quality* was the keynote at the beautiful new Galt Ocean Mile Hotel. This luxurious \$3,000,000 building is the first of 25 new hotels to be built on a one mile, \$19,000,000 stretch of beach inside the city limits at Fort Lauderdale, Florida.

Of course *delivery* and *price* were important factors, too. Two RECO Cement-lined Hot Water Storage Heaters (48" x 192" and 48" x 264") "more than adequately" met all three of these requirements according to William D. Cross, Mechanical Contractor.

RECO offers you a complete line of heat exchange equipment—all ASME inspected and guaranteed. Write for 20-page storage heater catalog showing dimensions, diagrams and details. Address RECO, Dept. C, 7th and Hospital Sts., Richmond 5, Va.

CONVERTERS STORAGE HEATERS INSTANTANEOUS HEATERS HEAT RECLAIMERS STORAGE TANKS

**RICHMOND ENGINEERING CO., INC.**

most 600 tons. It was placed in three separate pours of one story each. The separate sections were joined with 3-in. x 10-in. keys at each floor line. Cell forms were stripped in seven days and each pour was accomplished in a regular eight hour working day. With good shale underground, sufficient foundation support was developed from 5-ft wide footings going 18 inches underground.

#### Standard Defense Department Specs

The Department of Defense has adopted a uniform specification for use in procuring engineering drawings and for the use of the Armed Forces. A new standard also has been issued covering types and definitions of engineering drawings.

According to the DOD release, "the uniform specification is a first step in a long-range program to establish a basis for interchange of costly engineering data among the military departments and their contractors. Interchange of drawings would bolster economy and efficiency in drafting rooms of industrial concerns by reducing the variety of requirements military contractors must now meet. This in turn will result in appreciable savings in engineering talent."

The standard specification replaces, in whole or in part, 158 specifications that formerly were used as the basis for procuring drawings. In addition it:

• Requires the uniform use of present military standards in the preparation of drawings for military application.

• Invokes a new military standard which for the first time defines the types of drawings that may be acquired by the military departments and is designed to assure that only the minimum amount of engineering detail, consistent with actual requirements, is procured.

• Establishes uniform requirements for selection of materials from which drawings will be made to assure satisfactory reproducibility.

• Sets up a standardized order of precedence for design identification of items and establishes uniform requirements for identifying such things as inseparable assemblies and parts which are alike, but symmetrically opposite.

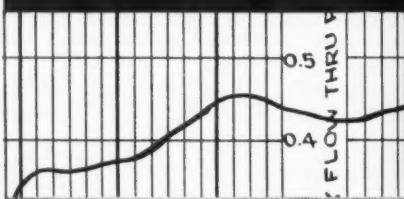
• Establishes minimum requirements for data to be placed on lists of materials (parts) to be used with drawings.

• Introduces a system of coding drawings to identify their source.

• Requires that proprietary or patent data which may appear on drawings be negotiated as part of the contract or order under the provisions of the Armed Services Procurement Regulation.

• Contains a check-off list for use by military procurement officers in ascertaining that all require-

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...For Measuring Sewage,  
Industrial Waste and Other Flows



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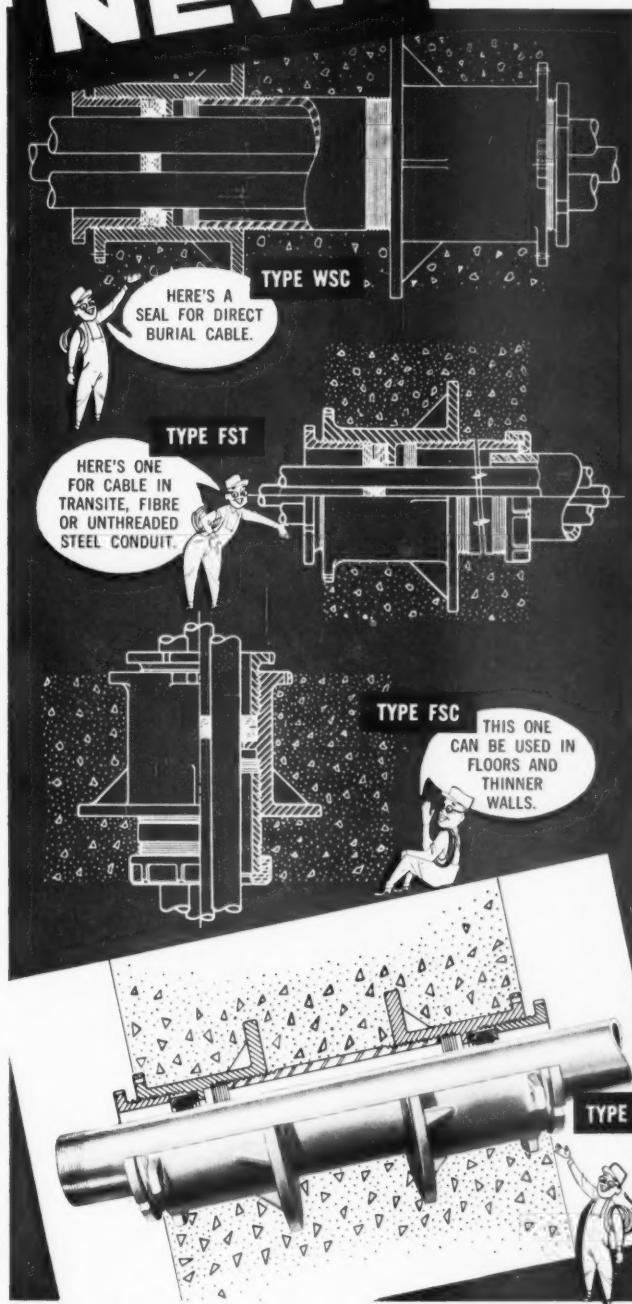
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ments for drawings are properly identified in the contract or order, without omissions.

#### Rehabilitate LA Schools

All Los Angeles city schools constructed before 1933 and not previously rehabilitated have been slated for reconstruction.

Collaborating in the program are the following consulting engineers — Charles E. Stickney, structural engineer; John C. Freeman, mechanical engineer; and Earl Holmberg, electrical engineer. Architectural coordinator is John J. Sturgis.

Wire mesh and reinforced plaster is being used in the rehabilitation program. The combination is designed for earthquake resistance.

As a pilot operation, the 28-year-old Elizabeth Street Elementary School was reconstructed at a cost of \$159,000. Replacement cost for the building would have been approximately \$300,000. The wire mesh-plaster combination stretches around the building, on the exterior and interior, at the second story level.

#### Mass Transit in Houston

Mayor Lewis Cutrer of Houston has appointed the city planning director and the city traffic director to prepare a master plan for public mass transportation to cover the city's needs for the next 15

to 20 years. The study is expected to be completed next year, on the basis of present plans.

The mayor said the survey can include "more buses or better types of buses, a monorail system, or some other type of mass transportation, or more parking space downtown." He also authorized the city officials to call in outside consulting firms.

#### New Space-Missile Center

A \$23-million space-missile research and development center, composed of six buildings on a 100-acre tract near Boston, has been dedicated.

Major structures in the research center include an administrative building, two laboratories, and



One of two laboratory buildings in new space-missile center near Boston. Note the free-standing columns.

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an experimental manufacturing building. Mechanical, electrical, and structural engineering was done by Metcalf & Eddy, of Boston.

Experiments in high velocity, high pressure, high temperature tests on missile models will be conducted in an arc wind tunnel building. A ballistics range building will house experiments on projectile models in free flight. On these two structures, mechanical and electrical engineering was done by Cosentini Associates, of New York City, with structural engineering by DiStasio & VanBuren, also of New York City.

#### Consultants Study EHV

General Electric has asked a 12-man committee of consulting engineers to review progress on an experimental extra-high-voltage transmission system, "Project EHV."

The prototype transmission line, which eventually will carry power at 750,000 volts, is being built by General Electric and five cooperating companies along the Housatonic River, near Pittsfield, Mass. Land already has been cleared for a portion of

# **LENNOX** "OG" SERIES

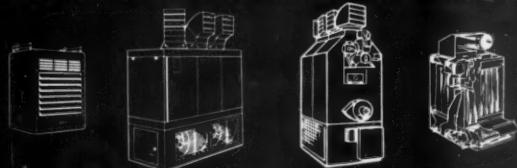
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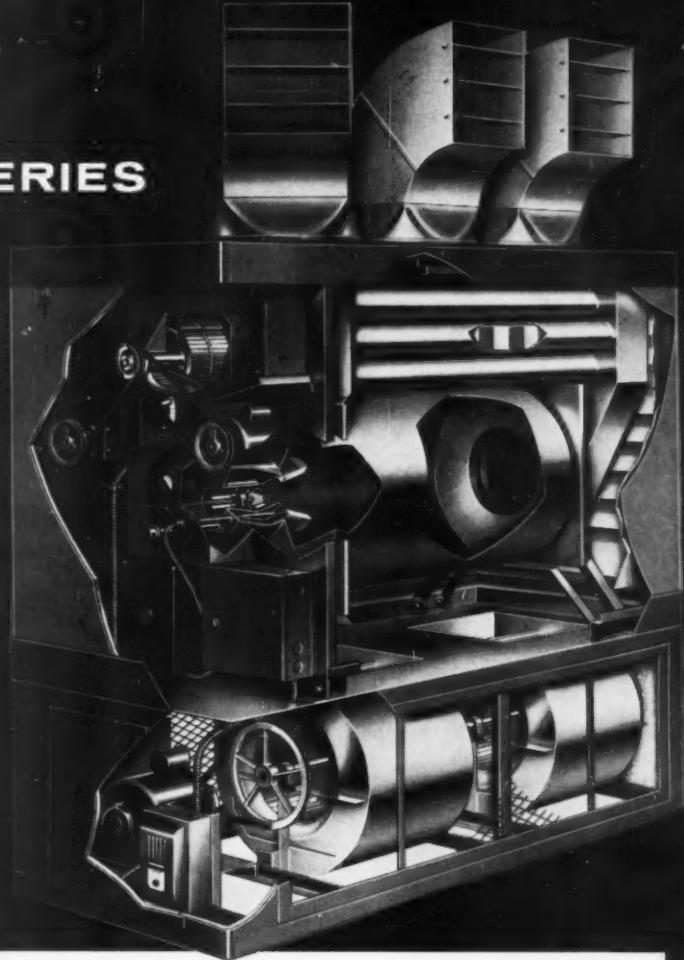


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### Typical Sequence of Combination Burner Operation

- 1 Thermostat calls for heat.
- 2 Combustion air and induced draft blower starts and runs for 25 seconds providing a pre-purge period.
- 3 Pilot is spark ignited and must be proven within five seconds by lead sulfide scanner.
- 4 When pilot is proven, the main gas or oil valve opens.
- 5 There is now a 10-second trial for ignition period which is also monitored by the scanner. Pilot flame is then extinguished.
- 6 If ignition fails, main burner shuts down immediately.
- 7 Main flame is continuously monitored.
- 8 When the thermostat is satisfied, main valve shuts off. Combustion and induced draft blower continues to run for 30 seconds providing a post-purge period.

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the line, and construction of a substation, administration building, and the first towers was scheduled for late spring.

According to General Electric, "Project EHV is designed to explore the transmission voltages of the future, to extend scientific knowledge in the field, and to gain practical construction and operating experience."

The consultants' committee includes: John E. Barkle, Bechtel Corporation, San Francisco; P. L. Bellaschi, P. L. Bellaschi Inc., Portland, Ore.; J. P. Kesler, Black & Veatch, Kansas City, Mo.; R. E. Moran, Charles T. Main Inc., Boston; J. Harold Foote, Commonwealth Associates, Jackson, Mich.; S. B. Smith, Ebasco Services, New York City; A. H. Phillips, Gilbert Associates, Reading, Pa.; John C. Hitt, Jackson & Moreland, Boston; T. O. Millard, Pioneer Service & Engineering, Chicago; E. G. Norell, Sargent & Lundy, Chicago; O. E. Charlton, Southern Services, Birmingham, Ala.; and J. O'R. Coleman, Stone & Webster Engineering Corporation, Boston.

#### Jersey Dikes

A Dutch engineer has prepared plans showing how 15,000 acres of New Jersey meadowland could be reclaimed. The construction of a dam and 17 miles of dikes, would pave the way for billions of dollars

worth of new investments in this important area located so close to the city of New York.

Pieter Westbroek of The Netherlands Engineering Consultants, retained by the Meadowlands Regional Planning Board, explained that a dam could be built across the Hackensack River, between Kearny and Secaucus. The dam would block tidal action up the Hackensack River. The dam would be met by 16-ft high elevation dikes which would extend to the highlands of Jersey City.

Construction costs alone were estimated at between \$15 million and \$17 million. The dam, with navigation locks, would cost between \$8 million and \$10 million. Another \$5 million would be needed for the dikes, with an additional \$2 million for five pumping stations for drainage units. Other costs would include the installation of roads and sewers and the acquisition of privately-owned marshland.

The Dutch firm recommended the dedication of about 2700 acres for recreational use and for impounding basins to be flooded by the runoff from the watershed as needed.

#### The Channel Tunnel

With what the English term "reasonable weather," a new search for a tunnel route across the English Channel is to be completed by mid-summer.

A converted LST, the 457-ton Ian Salvor III, is drilling a series of boreholes off the Dover coast, and will bring to the surface rock specimens from 200 feet below the seabed. Object of the study is to confirm a geophysical survey made last year by an American firm, Technical Studies Inc. That survey is reported to show "astonishing agreement" with a French study made a century ago.

Holes in soft rock first will be sunk by percussion boring, with a 6-ft long chisel on a cable run down a casing from the drilling platform and bounced into the seabed. A borer will bring up these samples. When the rock becomes harder at greater depths, boreholes will be made by diamond drills through a lining tube driven into the seabed. Six-in. diameter cores of rock will be removed for laboratory analysis, and there will be water absorption tests at various levels. Special equipment to record properties of the various soils will be lowered into the boreholes, as in oil well drilling.

From these borings, it is hoped to find a feasible route for the tunnel along the lowest of the three layers of chalk — the only impermeable layer — underlying the Channel bed. Beneath these chalk layers lie gault clay and greensand. Boring will indicate where this bottom layer of chalk is fault-free and thick enough for safe tunneling.

The Channel Tunnel Study Group, formed in 1957, has members from the English Channel Tun-



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6. A laboratory test showed Roseal to have about 7 times higher wet-surface resistivity than neoprene.\*
7. Has less deformation at operating temperature than neoprene.
8. Not only meets all of the requirements of IPCEA specifications for polyethylene jackets but, in addition, meets original horizontal flame test requirements of Underwriters' Laboratories.

\*Unshielded cable

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nel Co., the French Channel Tunnel Co., the Suez Canal Co., and Technical Studies Inc. Contractor for the study group is George Wimpey & Co.

Work on the original Channel Tunnel scheme stopped in 1883 after shafts and pilot tunnels had been driven a short distance under the sea from both the British and French sides. Opposition to the project then came from Britain. The Duke of Cambridge and Sir Garnet Wolseley had insisted that French soldiers disguised as tourists easily could invade England. When the idea again was raised in 1930, military objections were repeated.

In 1855, the Abbe Angelin suggested dropping a big iron tube from Cape Gris Nez to a point between Folkestone and Dover, its own weight to carry it "below the upper oolite layer on the French side of the Channel and above the white chalk on the English side."

#### Building Does Teaching

At Stevens Institute of Technology, a new electrical engineering, physics, and metallurgy laboratory and classroom building has been dedicated. The building was designed so that the electrical system can be studied as a classroom project in both laboratory and lecture sessions.

Slocum & Fuller, New York consulting engineering firm, arranged all services so the mechanisms

can be observed in operation. The main service switchgear has glass side panels and is illuminated from the inside.

Materials also were selected with an eye to being teachers' aids. Both dry and liquid type transformers are provided. Aluminum and copper bus ducts are used, in addition to various types of cables applied in different manners.

Both a.c. and d.c. current is provided, with 400 and 60 cycle distribution systems on the a.c. and



*Slocum & Fuller was electrical consultant on educational-engineering building for Stevens Institute.*

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variable voltages on the d.c. Power enters the building at 4160 volts, and the service entry substation is screened for easy viewing.

In order to keep waste ceiling space to a minimum in the auditorium, ductwork was run directly through overhead beams.

Structural engineering for the building, which was dedicated about one month ago, was done by Weinberg, Friedman, Linzer & Quinn, consulting engineers located in New York City.

#### New Power Station for Thailand

The Yanhee Electricity Authority of Thailand has awarded the Kuljian Corporation, Philadelphia engineers and constructors, a \$17.5-million contract for the first of three 77,000 kw thermal stations to be built in Bangkok.

In addition to the three thermal stations, the semi-outdoor power plant ultimately also will include a 270,000 kva substation. The project contains a centralized control room, outdoor coal storage and dry ash handling facilities.

The Yanhee Electricity Authority obtained a loan of \$14.5 million from the Export-Import Bank of Washington. The loan covers all power plant equipment and materials supplied from the U.S. □

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HANDWHEEL

YOKE BUSHING

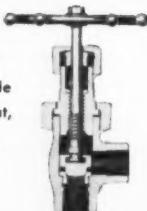
GLAND-STUFFING BOX

BONNET JOINT

SEAT-DISK JOINT

EDWARD FIG. 848  
GLOBE VALVE  
ILLUSTRATES  
VALVE SELECTION PRINCIPLES

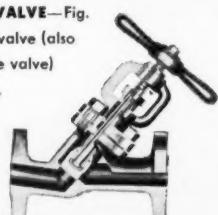
**1 ANGLE VALVE**—  
Fig. 2699, 600 lb at  
900F (2000 lb WOG)  
with union bonnet, inside  
screw, replaceable seat,  
knobbed handwheel,  
and screwed ends.  
Sizes  $\frac{1}{4}$ " to 1".



**2 UNIVALVE**—Fig.  
2224, 1500 lb at 1050 F  
(3600 lb WOG) or 2500  
lb at 1050 F (6000 lb  
WOG) with outside  
screw, Impactor\* handle  
seal-welded bonnet,  
integral seat and  
socket welding ends. Sizes to  $2\frac{1}{2}$ ".



**3 BLOW-OFF VALVE**—Fig.  
641, straightway valve (also  
available as angle valve)  
300 lb at 850 F,  
600 lb at 850 F,  
1500 lb at  
850 F, with  
integral Stellite  
seat, flanged  
ends, bolted bonnet. Sizes to  $2\frac{1}{2}$ ".



## What's New from Edward Valves

New Products . . . Solutions to Problems . . . Information on Steel Valves from Edward, Long-Time Pioneer in the Field!

# HOW TO SELECT FORGED STEEL VALVES

When you need forged steel globe or angle valves (2½" and smaller) for high-pressure and/or high-temperature applications, you can save money on your installations as well as reduce future maintenance expense by making sure you select the proper valve. Here are a few suggestions.

### VALVE CONSTRUCTION DETAILS

(See large illustration, opposite page)

**Valve Handwheel or Handle** should be large enough to operate valve easily. Wheel spokes help keep handwheel cool. Knobbed design permits tight grip even with greasy gloves. Impact type handle will be helpful in obtaining tight closure for valves 1½ to 2½ in.

**Yoke Bushing** material should be checked. High-strength aluminum bronzes are usually best. Look for ample thread engagement between bushing and yoke and between bushing and stem.

**Gland-Stuffing Box**—Stuffing box with bolted gland assures good packing compression; hinged bolts swing out of the way but don't get lost. Be sure to get stainless steel bolts for maximum resistance to rusting, and for easy adjustment even after years of service. Packing chamber should be deep and not excessively wide.

**Bonnet Joint** of bolted construction is easiest to work with. You can disassemble and reassemble with pocket-size tools. Union bonnet is compact and usually less expensive for smaller valve sizes, but is not recommended for high temperatures. Bonnet gasket of soft iron performs well in most services but spiral wound metallic-asbestos gaskets are superior in high temperature services. For extreme pressure-temperature services welded bonnet joints for permanent tightness are desirable. Seal-

welded type bonnet has advantage over fully welded design because it permits disassembly and reassembly.

**Seat-Disk Joint**—An integral hard-faced seat is generally regarded as superior to screwed seat construction because it eliminates body-seat leakage and retains hardness under temperature. A hard faced disk or disk of special alloy is desirable in high temperature services; but 13 per cent chromium stainless steel is an excellent all purpose material below 750 F.

**Other Features to Evaluate**—Valve compactness is important because you frequently find small piping located in crowded quarters. Inclined bonnet globe valves are less likely to erode due to high velocities—have less pressure loss. Valves of "inside screw" design (stem threads below packing chamber) are usually lower priced and give good service where temperature is not too high and where line fluids are free of sediment. But, best design and materials are useless without experienced workmanship and rigid quality control.

### VALVE APPLICATION SUGGESTIONS

First, determine whether a standard valve will do the job before ordering expensive special designs. (Your Edward Representative can help you decide.) Often a slight modification of a standard valve, or a combination of standard valves, will do the job. Here are some facts about types of standard valves and their application:

- For many services, angle valves (illustrated by valve #1) reduce installation cost, minimize pressure drop, improve operational convenience. All Edward forged steel stop and stop-check valves from ¼" to 2½" sizes are available in the angle version.

- For high temperature, Edward forged steel valves with seal-welded bonnets (#2) permanently maintain pressure tightness without periodic tightening of bonnet joints.

- For blow-off service, or wherever double valving is required, select sets of valves of the same basic type with hard-faced seating surface for dependability, longer life and interchangeability of parts (#3).

- For permanent tightness, select an instrument valve (#4) with corrosion-erosion resistant hard-faced seat or a valve with stainless steel body. Bonnetless design requires less maintenance.

- Piston-type check valve (#5), available with union, bolted, or seal-welded cover, is best for most services because it will seat tighter, has easily repairable seat face.

- Modern globe and angle stop valves (shown here) are more dependable than gate valves where repeated drop-tight closures are required, may be used for approximate flow regulation and moderate throttling.

**YOUR EDWARD REPRESENTATIVE** will be glad to give you the complete story on these features, plus the many other advantages of Edward valves—such as positive, pressure-tight backseats, self-centering disks, special stem and packing materials, and many others. Edward builds a complete line of cast and forged steel valves for pressures to 10,000 lbs. For additional information write to Edward Valves, Inc., 1210 W. 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company. Represented in Canada by Lytle Engineering Specialties, Ltd., 360 Notre Dame St., W., Montreal 1, Quebec.

**4 INSTRUMENT VALVE**—Fig. 952Y, 600 lb or 2500 lb at 850 F (6000 lb WOG) with swing bolted gland, socket welding ends, no bonnet joint. Sizes ¼" to 1".



**5 CHECK VALVE**—Fig. 5538, piston type, 1500 lb at 1050 F (3600 lb WOG) bolted bonnet, screwed ends, integral Stellite seat. Sizes ¼" to 2".

\*T.M. Reg. U. S. Pat. Off.



### EDWARD STEEL VALVES

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Catalog 14 contains full data on the complete Edward line of forged and cast steel valves from ¼" to 18"; in globe and angle stop, gate, non-return, check, blow-off, stop-check, relief, hydraulic, instrument, gage and special designs; for pressures up to 10,000 lbs; with pressure-seal, bolted, union or welded bonnets, with screwed, welding or flanged ends.



## DESERT-HOT BY DAY

### Modern heavy-duty Asphalt pavement to endure years of heavy traffic

#### ...solves problem of extreme variations of sub-soil bearing values, too.

Here's another Asphalt-paved Interstate highway.

Laid right through the heart of California's forbidding Mojave Desert, from Victorville to Barstow . . . this modern, heavy-duty freeway proves once again that no pavement is as versatile and economical and none is stronger or more durable than a well-constructed Asphalt-concrete pavement.

The project . . . 29.335 miles long . . . is one section in the planned conversion of U. S. 66-91 to Interstate Highway 15. Opened to traffic

Asphalt-concrete shoulder dike prevents erosion, aids safety . . . may be placed quickly. To guide desert freshets to prepared drains and to provide a clearly defined shoulder edge, the design of the Victorville-Barstow project called for six-inch-high Asphalt-concrete shoulder dikes. Here you see one being placed at a rate of 24,000 feet per day by modern commercial equipment.

only last December, this outstanding Asphalt pavement already carries about one-fifth of all traffic between California and neighboring states. By 1980 it is expected to carry 33,600 vehicles per day at speeds up to 70 MPH . . . including some 2800 heavy-duty trucks.

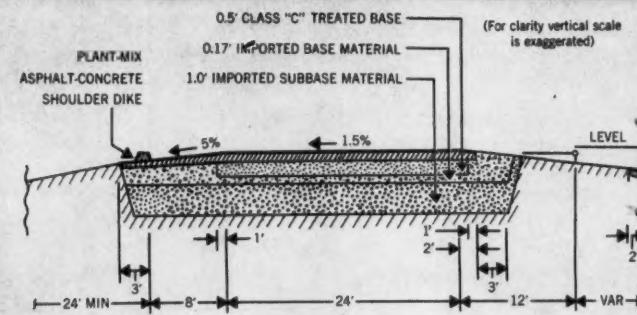
This rugged Asphalt pavement cost only half as much as comparable concrete pavement to perform the same service.\*

#### Asphalt design overcomes drastic temper- ature changes and varying soil conditions.

In the desert country between Victorville and Barstow, temperatures of pavement surfaces sometimes vary by as much as 140°F by day to freezing at night. Here, too, "R-Values"\*\* of the soil vary from as low as 10 to as high as 75.

Asphalt-concrete pavement provides for a minimum of expensive materials . . . yet conforms to highest U. S. Bureau of Public Roads strength requirements for Interstate Highways. Notice below that 20 inches of

#### CROSS SECTION OF VICTORVILLE





## DESERT-COLD BY NIGHT

### on California Interstate 15 has ruggedness and drastic temperature changes

To provide a pavement of predictable strength and the durability to stand up under heavy traffic in the face of these drastic conditions, the engineers stripped top cover and constructed subbases and bases of required thickness and quality from nearby borrow.

In this heavy-duty but lower cost pavement, the wearing course is  $\frac{1}{2}$ -inch of open-graded hot-mix Asphalt surfacing and the leveling course is 3 inches of dense-graded hot-mix Asphalt concrete placed in two courses  $1\frac{1}{2}$ " thick. An Asphalt prime coat binds the leveling course to the base.

Construction speeds proved excellent...only 17 months to opening day...only 14 weeks to lay the 250,000 tons of Asphalt concrete. And the pavement is superbly smooth-riding.\*\*\*

the  $2\frac{1}{2}$ -inch pavement structure is low cost material imported from a local source. This same source supplied aggregate for the Asphalt plant mix at a relatively low cost.

#### BARSTOW PROJECT, CALIFORNIA

Modern Asphalt-concrete pavements...engineered and constructed like the Victorville-Barstow project...are **reputation builders** and **tax savers**. Sure to benefit you and your state for years to come! Specify Asphalt concrete for **your** Interstate highways.

\*Based on comparable pavement costs in the same highway district.

\*\*California-developed standard which compares soils on basis of their resistance to plastic deformation under load.

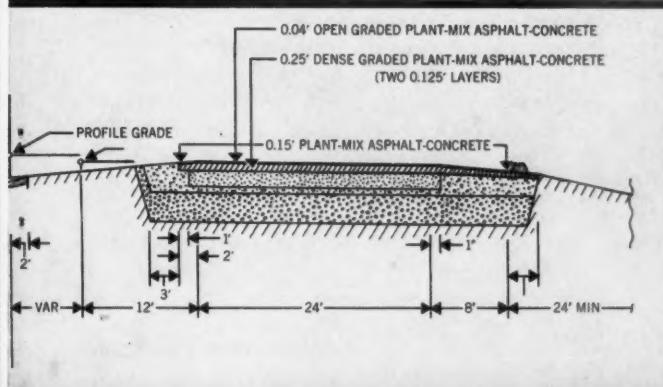
\*\*\*Average Profile Roughness Index 2 inches per mile.

*Ribbons of velvet smoothness...*  
**ASPHALT-paved Interstate Highways**

**THE ASPHALT INSTITUTE**  
Asphalt Institute Building, College Park, Maryland



Set of "doubles" speeds along Asphalt-concrete pavement in comfort and safety. Modern tax-fund-stretching Asphalt pavements are now being specified for many of the nation's heaviest-duty roads. Experience (with the New Jersey Turnpike, with jet plane runways, for example) proves these rugged, durable Asphalt pavements stand up under heaviest traffic.





# Men in Engineering

Ruth Gordon Schnapp is the mother of three children and, incidentally, the first woman to be licensed as a structural engineer in the state of California. Mrs. Schnapp has a B.S. in civil and an M.S. in structural engineering, both from Stanford. She was licensed as a civil



SCHNAPP

engineer in California in 1953, and was the first woman member of the Structural Engineer's Association of Northern California. Mrs. Schnapp has spent six years with consulting firms on the West Coast. She is presently with the State of California, Division of Architecture and obtained her structural license earlier this year.

A new partnership, Hastain & Deatherage, Consulting Engineers, has been formed, with offices at 1006 North 7th Street, Phoenix, Arizona. Principals are James E. Hastain and James H. Deatherage.

Kenneth D. Cummins, formerly associate professor of civil engineering, University of Detroit, has been

appointed technical director of the American Concrete Institute. His duties with the Institute include field and office work to promote and improve technical relations with other technical societies and organizations, assist member groups in organizing and conducting small local meetings, and upon request, assist ACI technical committees in preparation of reports. Cummins' professional affiliations include the Engineering Society of Detroit and the Consulting Engineer's Association of Michigan. He is a registered professional engineer in Michigan, Ohio, Indiana, and Illinois, and a registered land surveyor in Michigan.



CUMMINS

CRON

Colonel Robert E. Cron, Jr., has joined Fay, Spofford & Thorndike, Inc., consulting engineers, as senior engineer in the firm's Phoenix office. Colonel Cron retired from the U.S. Army in 1957, and for the past two years has been on the faculty of Arizona State University.

Harvey F. McPhail, manager of the Hydroelectric Division, The Kul-

jian Corporation, Philadelphia engineers and constructors, received the Distinguished Nevadan Award from the University of Nevada at the 69th commencement exercises held recently. McPhail, formerly Assistant Commissioner of the Bureau of Reclamation and an alumnus of the University, received the award for his contributions to the economic and scientific advancement of the State of Nevada and the nation.



MC PHAIL

MARSTON

Frank A. Marston, a partner in the Boston engineering firm of Metcalf & Eddy, has been named the official nominee for president of the American Society of Civil Engineers for the year 1959-60. The nomination of Marston came at a meeting of the Board of Direction of the Society in convention session in Cleveland. Designation of Marston as the official nominee for the high office in the 107-year-old engineering society implies that Marston is the choice of the national officers for the post. Election will be by mail ballot of the 42,000-plus membership of the Society this summer, and the new president will take office at the October ASCE convention in Washington, D.C. He will replace the current president, Francis S. Friel, of Philadelphia. Marston is a former vice president of ASCE and once served as a director. He became a member of ASCE in 1910, and now holds the status of Life Member.

Frank M. Gibbons has joined Commonwealth Services Inc. as supervisor of the firm's oil refining and



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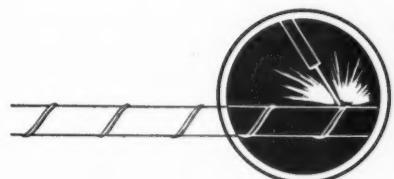
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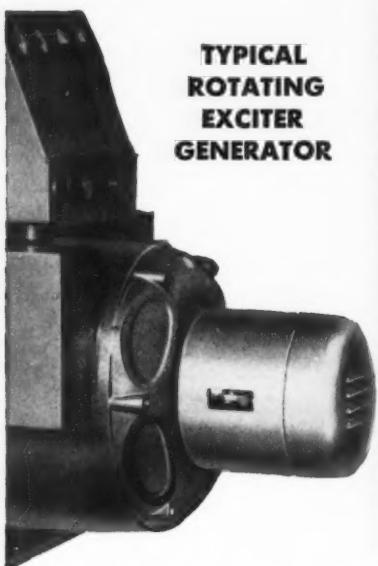
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petro-chemical consulting activities. Gibbons, formerly a project manager for oil refinery engineering and construction at Fluor Corporation, Ltd., is stationed in the company's Houston, Texas office.



GIBBONS



MIRRER

Raymond Mirrer, partner of the New York consulting firm of Becher & Mirrer, has been elected vice president of Strato-Missiles, Inc. Mirrer, a registered professional engineer and a lawyer, was installed recently as president of the Brooklyn Engineers' Club.

William Thompson, formerly assistant chief inspector with The Fluor Corporation, Ltd., has been named chief inspector with the company.

G. Brooks Earnest, president of Fenn College, was elected to the presidency of the Cleveland Engineering Society. Earnest succeeds Roscoe H. Smith, secretary, Reliance Electric and Engineering Co.

William M. Cooper, formerly vice president and chief project engineer for George E. Wells, Inc., consulting engineers, St. Louis, has been appointed vice president in charge of research and product development of the Champion Manufacturing Company.

John C. Bumstead has been named an associate of Alden E. Stilson & Associates Limited, consulting engineers of Columbus, Ohio.

Martin Lovett, consulting structural engineer, has moved his of-

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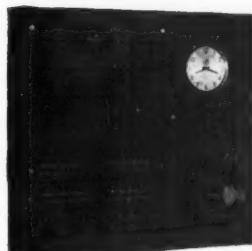
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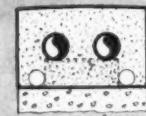
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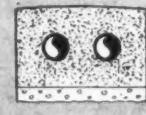
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fice to The Architects Building, 101 Park Avenue, New York, New York.

Strobel and Rongved, consulting engineers of New York City, has opened a branch office at 1028 Connecticut Avenue, N.W., Washington, D.C.

Andrew Fischer, Jr. has been retained to direct the construction activities of Charles Luckman Associates, architectural-engineering-planning firm of New York. In this newly created post, Fischer will organize total construction supervision of Luckman projects throughout the eastern United States, including the Prudential Center in Boston. Until recently, Fischer had served as consultant for planning and construction for the \$130 million new Chase Manhattan Bank building.



FISCHER

ENGEL

David J. Engel has joined Bernard Johnson & Associates, Houston consulting engineers, as chief structural engineer. Engel formerly was with Walter Kidde Engineers as design engineer in charge of the preparation of plans for various industrial structures in Tennessee and South Carolina.

The 1959 NSPE Award for outstanding service to the engineering profession was presented to William F. Ryan, former vice president of Stone & Webster Engineering Corporation, at the Silver Anniversary meeting of the National Society of Professional Engineers in New York City. The ninth individual to receive the Award since



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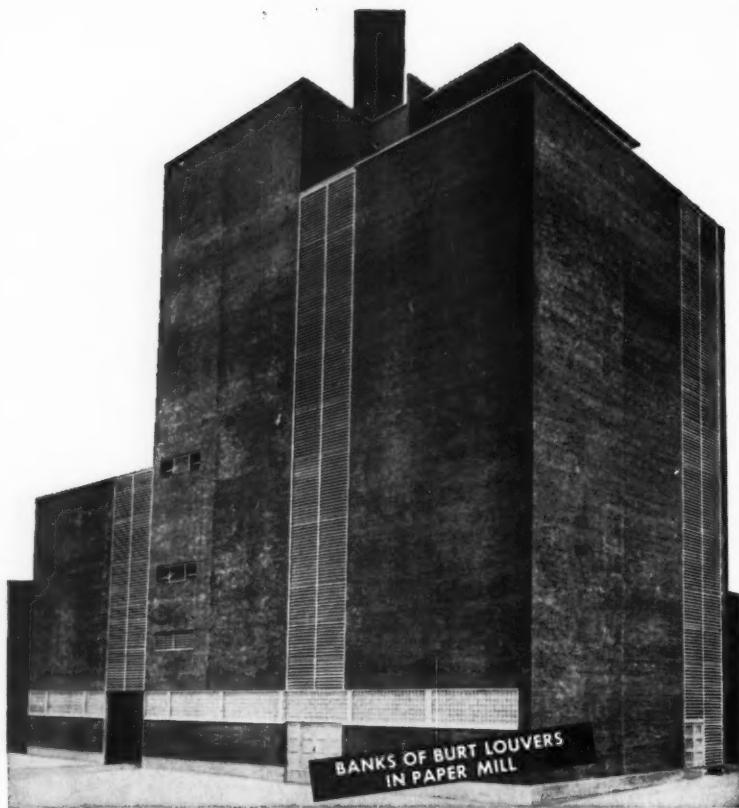
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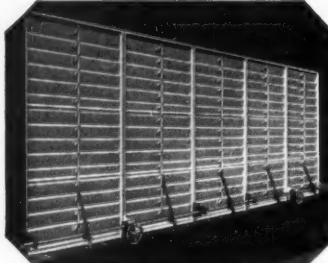
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it was first made in 1949, Ryan was cited for his "outstanding contributions as a professional engineer in the field of mechanical design, for his unselfish devotion to professional principles and ideals, and more importantly, his untiring efforts in the practical implementation of these concepts for the benefit of the profession and mankind." Other recipients of the Award include Herbert Hoover, David B. Steinman, Charles F. Kettering, Donald A. Quarles, and Granville M. Read.

A new firm, Campbell-Evans, Consulting Engineers, has been formed, with offices at 3381 Gorham Avenue, Minneapolis 26 (St. Louis Park), Minnesota. Principals are



CAMPBELL



EVANS

Donald C. Campbell, formerly with Nielsen and Bruch, consulting engineers, and Dale V. Evans, formerly with Magney, Tusler and Setter, architects.

Alfred G. Rayner, consulting engineer of Baton Rouge, Louisiana, has been named president of the Gulf Institute of Consulting Engineers. Other officers include: T. Edward Ernst, New Orleans, first vice president; B. M. Dornblatt, New Orleans, second vice president; and John P. Jones, Baton Rouge, secretary-treasurer.

Richard R. Kennedy and Robert M. Kennedy, partners in the Engineering Office of Clyde C. Kennedy, announce that the firm's name has been changed to Kennedy Engineers. ▲

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# Books

## Parallel Reading for Consulting Engineers

*The Status Seekers*, by Vance Packard, is a complete handbook for the young social climber and the aspiring snob. It not only tells them where to go and how to get there, but when they have arrived. As one chapter-leading quotation points out, "The folks on top probably like it better than those on the bottom." They will probably feel the same way about this book.

For instance, the consulting engineer will be gratified to learn that good scientists and engineers have an I.Q. of about 135, putting them in the top 1 or 2 percent of the United States population. How do clients compare? "Business executives, interestingly, do not need such brilliance and, in fact, might find it a handicap in trying to communicate with associates if they did have such an I.Q." (Top executives and draftsmen have similar averages — 120 I.Q.)

Unfortunately, engineers do not come out so well on a monetary or prestige basis. Doctors average from \$15,000 (general practitioners) to \$35,000 (surgeons); dentists, \$12,000; and mechanical and electrical engineers (the only kind Packard has heard about, judging from the book), a "little above \$7000." The fallacy here is that the average for engineers is based on a predominantly employee group while the doctors and dentists are mostly in private practice. It would have been more revealing to have compared the income of these medical men with the income of consulting engineers.

Doctors now are in the monetary lead, attorneys are a poor second, and engineers and scientists are a lagging third. It was not always thus. In 1929, lawyers were in first place on the scale of professional incomes, engineers and scientists second, and medical people third.

Why do doctors have such a financial lead on the other professions? A major answer seems to be that they have been exercising collective birth control on themselves. A scarcity — an artificial one, some charge — has been created, most often at the medical school level. The doctors have a difficult time explaining. "A few years ago, the dean of a Midwestern medical school sought to explain the limitations on entrance to his medical school by saying that there was a limited supply of cadavers!"

A large number of people were asked to rate various occupations, on a prestige basis. The engineer fell behind the architect here, but not badly. In the highest status group was the licensed architect, in company with such persons as the medical specialist. The second status group included the mechanical engineer ("registered" or "professional" engineers never were mentioned) and the "top-level executive, local firm."

Engineers are not the only group concerned with professional status. The nation's 25,000 undertakers have launched a campaign to become known as "funeral di-

rectors," a title of more dignity. According to Packard, "they are striving to become accepted as professional men 'on the same level as a doctor or lawyer.'"

"And if I am observed talking to him will it make me seem to belong or not to belong?" (Lionel Trilling)

Packard provides a handy cue to judging one's neighbors and the proper environment. If one is to be upper class:

¶ Never pay bills promptly. One could wind up in the class with the workingman's wife who pays by the 15th for fear of losing credit at the butcher's. ("In the real upper class, you are likely to see a monumental casualness about bills.")

¶ Do not use big words. ("Persons who feel secure in their high status can display their self assurance by using unpretentious language.") Proper Bostonians are notably blunt, verging on rudeness.

¶ Limit the time in the cocktail lounge, and never frequent the neighborhood tavern. ("As you go down the scale, the number of hours that people spend in these establishments increases.")

¶ Eat only hard-crust breads. ("Only restaurants catering to sophisticates will place hard-crust rolls in the basket. Restaurants striving for a mass appeal will emphasize soft buns and soft breads.")

¶ Live in the East or South. ("It is my impression that status lines are more carefully observed in the East and South than in most of the other parts of the country. Californians, with their yeasty social climate, seem the least status-conscious people I've encountered in the nation.")

Where does Packard get all of his inside information? He mentions rather vague investigations, "informal but intensive," and discussions. "Most important, in terms of the impact of this book, I have brought together the findings of more than 150 U.S. sociologists and other students of the social scene

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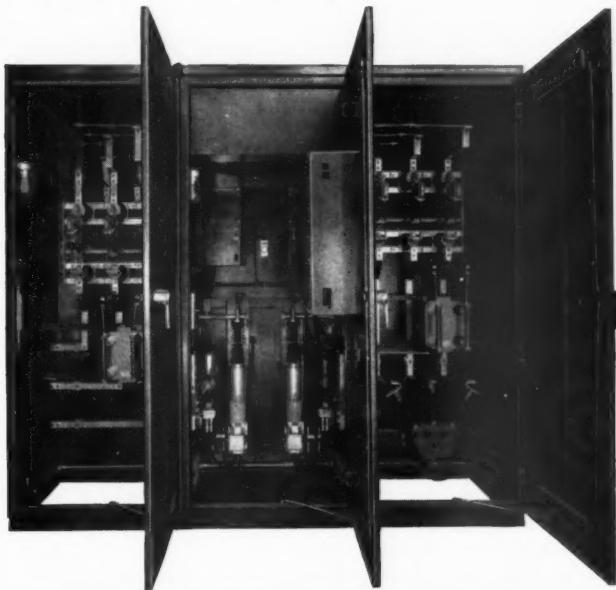
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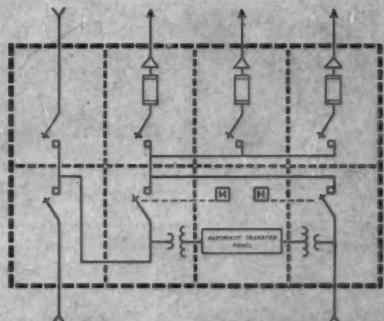
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who have been investigating phases of our social stratification, and I have tried to assess their findings."

Packard, also author of *The Hidden Persuaders*, has discovered the knack of making a fortune through a combination of an exciting idea, good rewrite, and a visit to the public library.

*Possibilities of Economic Progress*, by A. J. Youngson. Because many

American engineers have a stake in the economic development of the underdeveloped areas, Professor A. J. Youngson's book may hold interest for them. As a matter of fact, University of Edinburgh Professor Youngson argues that individuals — even individual engineers — pursuing their own ends, and oblivious of how these fit in the broad picture, in sum greatly influence economic progress — or even retrogression.

Professor Youngson states his case with moderation and humility; he is no intellectual bent upon organizing the economy — or engineers. By contrast, he simply examines existing economic theories about economic progress; somewhat hesitantly states his own; and then presents his theory in the light of historical experience.

The author examines his theory of economic progress in the light of the economic history of Great Britain (1750-1800); Sweden (1850-80); Denmark (1865-1900); and the Southern United States (1929-54). After writing about these areas in these times, Youngson draws certain conclusions or generalizations, and then checks his theory against these. Finally, and most tentatively, he makes some suggestions concerning policy with regard to the economic progress of underdeveloped areas.

In his survey of the history of economic development in England from 1750-1800, Youngson concludes that political security promoted economic growth. After the years of political turmoil in the 17th century, the law — not an arbitrary sovereign or legislature — governed in England. Private property and commerce enjoyed the protection of the State. During the 18th century commercial law developed enormously and offered the merchant and manufacturer protection not yet enjoyed in many other parts of the world.

Another factor promoting economic growth in England, according to the author, was the extension of foreign trade. In the 18th century England consolidated her supremacy on the high seas and in the colonial areas and found herself in possession of a rich trading area. At the same time that trade flourished and capital accumulated, an agrarian revolution in 18th-century England provided a solid foundation for industrial and commercial progress.

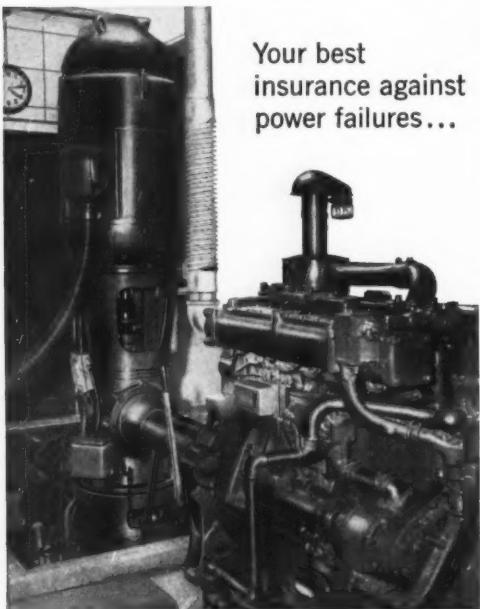
With foreign trade growing, political conditions favorable, agri-

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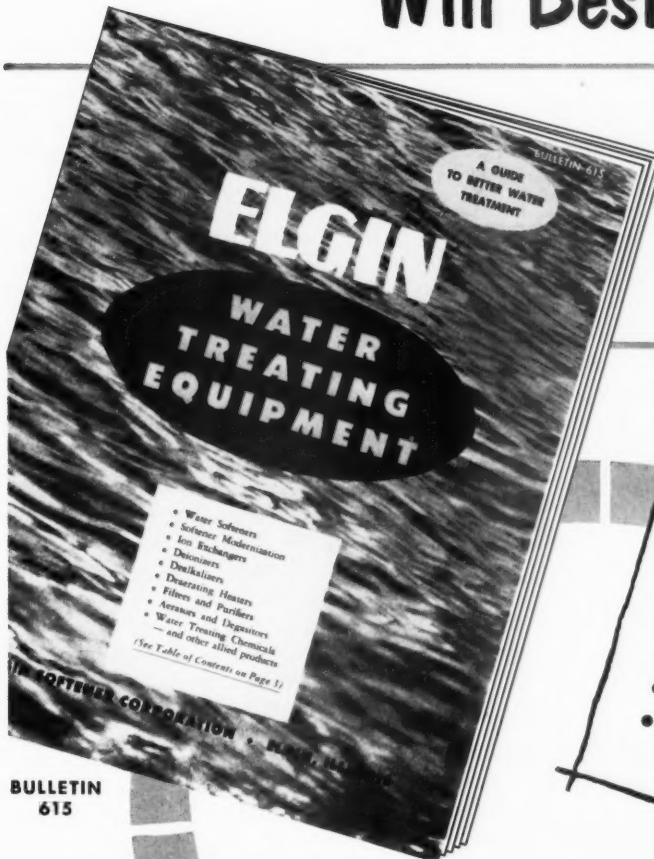


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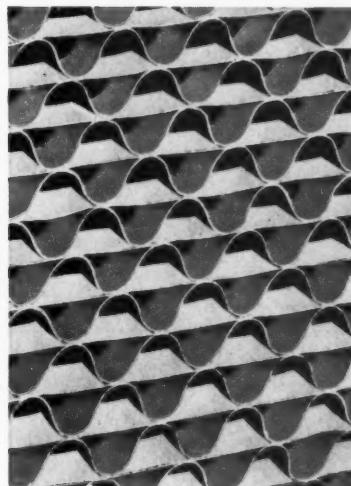
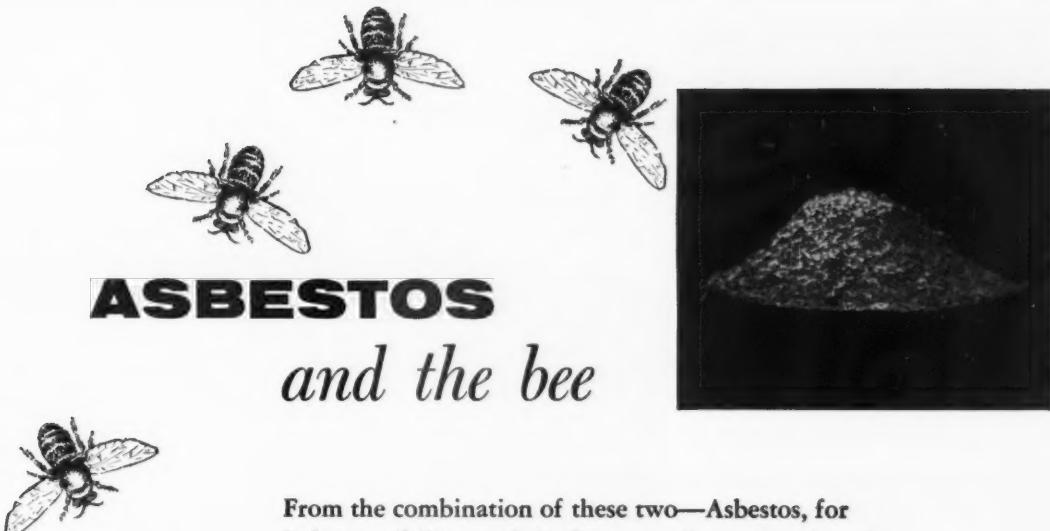
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textbook and reference for the practicing engineer presents the current knowledge of prestressed concrete in a detailed and informative fashion. Ample reference is provided, along with basic tables developed for design use.

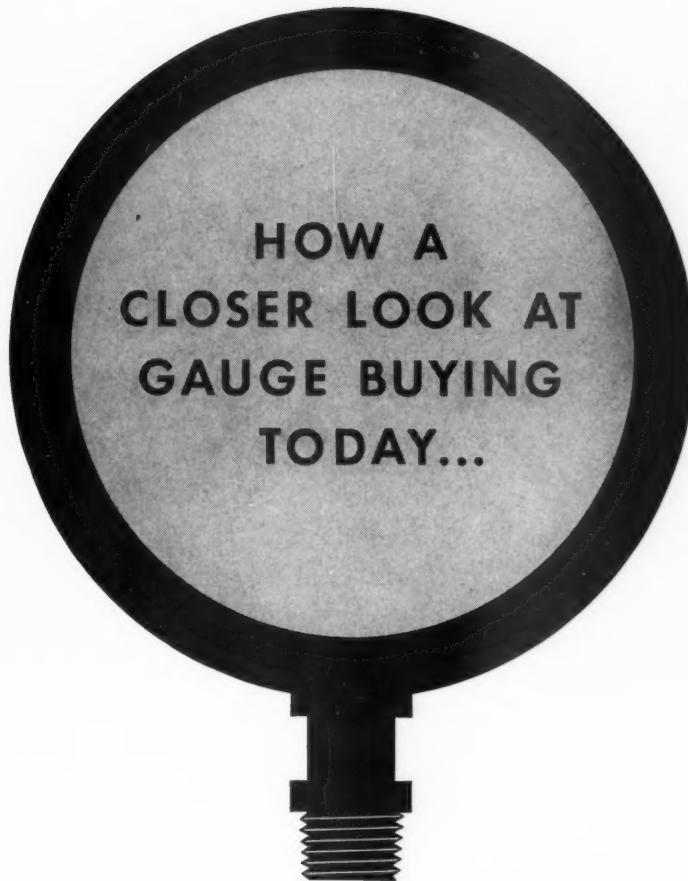
The book opens with an explanation of the basic principles which apply to all types of prestressed concrete structures. Information is also given on physical testing designed to confirm and extend theoretical conclusions. The middle section of the volume is devoted to the design of simply supported beams. This is followed by a discussion of some of the more specialized types of prestressed structures. These include prestressed units combined with additional concrete, statically determinate structures, indeterminate structures, liquid retaining structures, domes, and shells.

*H. F. Gonnerman  
Consulting Engineer*

REINFORCED CONCRETE FUNDAMENTALS, by Phil M. Ferguson; John Wiley and Sons, Inc., N.Y.; \$9.50. Both the conventional straight line and ultimate strength theories are developed in this introduction to reinforced concrete. The former is based on the 56 ACI Code, the latter on the ACI-ASCE Report (rectangular stress block). Accent is placed on the ultimate strength theory which is explained in a detailed and very straightforward manner.

Although not so intended, the book should be a real aid to those who may be confused by the intent of some parts of the ACI Code. It also does an excellent job of introducing the problems of how and why concrete acts as it does under load. Chief weakness of this book lies in the rather casual treatment which it gives to deflection and creep problems.

*John E. McCarthy,  
Structural Engineer  
A. V. Saph, Jr.*



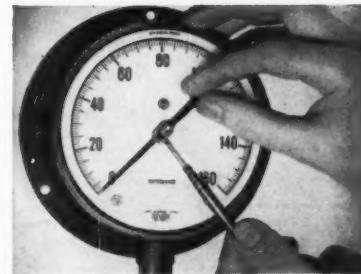
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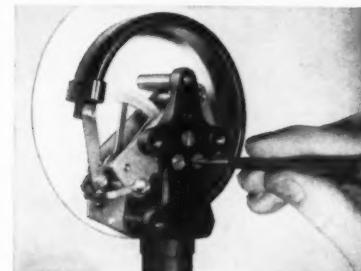
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# New Projects Reported

By Consulting Engineers

## ARKANSAS

**John F. Mahaffey & Associates**  
Fayetteville, Arkansas

¶ Fayetteville water distribution system. (civil) \$1.1 million. Client, City of Fayetteville, Arkansas.  
¶ Airport taxiway paving. (civil) \$70,000. Client, City of Fayetteville, Ark.  
¶ Dial telephone system. (elec.) \$140,000. Client, Decatur Telephone Co., Decatur, Arkansas.

**L. M. McGoodwin, Consulting Engineer**  
Fayetteville, Arkansas  
¶ Outfall sewer and sewage treatment plant improvements, Siloam Springs, Arkansas. \$160,000. (est.)  
¶ New sewage treatment plant and outfall sewer, Rogers, Ark. \$500,000 (est.)  
¶ Water treatment plant, Gravette, Arkansas. \$50,000. (est.)  
¶ Sewage treatment improvements, Decatur, Arkansas. \$30,000 (est.)  
¶ Sewage treatment plant improvements, Green Forest, Arkansas. \$60,000. (est.)

## CALIFORNIA

**M. Doberne**  
Los Angeles, California  
¶ Valley Cities Jewish community center, Van Nuys, Calif. Auditorium, clubrooms, and administration bldgs. (struc.) \$250,000. Client, Cohn & Graham.  
¶ St. Mark Lutheran Church, Encinitas, Calif. Church & classroom bldgs. (struc.) \$200,000. Client, W. R. Hagedorn.

**John R. Anderson, Structural Engineer**  
Pasadena, California  
¶ Distribution warehouse, Ventura, Calif. 10,000 sq ft, precast concrete, tilt-up, with wood bowstring trusses, rafters, plywood sheathing, and composition roofing. (civil, struc.) \$40,000. Client, United Parcel Service.  
¶ Office and service center for Keystone Camera Company at Grand Central In-

dustrial Centre, Glendale, Calif. 6500 sq ft, common brick, composition roofing, plywood sheathing, rafters, glued laminated beams. Friction pile foundations. (civil, struc.) \$47,000. Client, Grand Central Ind. Centre, Glendale, Calif.  
¶ Office and warehouse, East Los Angeles, Calif. 14,400 sq ft, precast concrete, tilt-up, composition roofing, plywood sheathing, rafters, and tapered steel girders. (civil, struc.) \$72,000. Client, D. F. Shaw, general contractor.

**Mackintosh & Mackintosh**  
Los Angeles, California  
¶ Six-story office building, Beverly Hills, Calif. (struc.) \$2 million. Client, Sidney Eisenshtat & Associates, architects and S. Jon Kreedman & Co., contractors.  
¶ Beverly Imperial Hotel, 9 stories, 5 basements, Beverly Hills, Calif. (struc.) \$6 million. Client, Charles Luckman Associates, architects, S. Jon Kreedman & Co., contractors.  
¶ Six-story medical building, Los Angeles, Calif. (struc.) \$2 million. Client, Sidney Eisenshtat & Associates, architects, S. Jon Kreedman & Co., con-

**F. E. MacDonald, Jr.**  
San Gabriel, California  
¶ Private school auditorium, gym, classroom, kitchen, 90- x 150-ft, masonry walls, rigid frame and roof system. (struc., mech., elec.) \$100,000. Client, San Fernando Academy, Northridge, California.  
¶ Private school multi-purpose gym, auditorium kitchen, 80- x 100-ft plus 30- x 110-ft cross wing. Wood frame and plaster walls. (struc., mech., elec.) \$60,000. Client, Ontario Christian School, Ontario, California.

**COLORADO**  
**Ken R. White Consulting Engineers, Inc.**  
Denver, Colorado  
¶ Support facilities for Lowry AFB mis-

sile facilities. (struc., civil, mech., elec.) Client, Corps of Engineers, Omaha Dist.  
¶ Jefferson County Airport, (struc., civil) \$400,000. Client, Jefferson County, Colo.

## CONNECTICUT

**Charles L. Nord**  
Hamden, Connecticut  
¶ Steel sheet bulkhead, concrete anchorage 640 feet. (struc., civil) \$150,000. Client, Michel Scharoni.  
¶ Prestressed concrete bridge span. (struc.) \$110,000. Client, Town of Southington, Conn.  
¶ Storm sewer. (struc.) \$30,420. Client, Town of Southington, Conn.  
¶ Investigation of building. (struc., civil) \$1500. Client, Dod-Allderman.

## DELAWARE

**Edward H. Richardson Associates**  
Newark, Delaware  
¶ Coventry (New Castle Hundred), 900-unit housing dev. with 25-acre shopping center. (civil) \$1 million, exclusive of houses and land. Client, Coventry, Inc.  
¶ White Clay Creek Hundred one-mile secondary road. (civil) \$125,000. Client, Delaware State Highway Department.  
¶ Todd Estates Section 4, 217-unit housing development, Newark, Delaware. (civil) \$225,000, exclusive of houses and land. Client, Todd Construction Co.

## DISTRICT OF COLUMBIA

**Herbert Manuccia, P.E. and Associates**  
Washington, D.C.  
¶ Office building, Washington, D.C. (civil, struc.) \$300,000. Client, Groll, Beach & Associates, architects and owners.

## ILLINOIS

**Sodemann & Associates**  
Champaign, Illinois  
¶ Primary sewage treatment plant; grit removal, screening, pumping, settling tanks, sludge dewatering control building, and outfall, Metropolis, Illinois. (struc., civil, mech., elec.) \$400,000. Client, City of Metropolis, Ill.  
¶ Activated sludge sewage treatment plant; grit removal, screening, pumping, settling tanks, aeration tanks, final settling, sludge dewatering, control building, and outfall, Sullivan, Illinois. (struc., civil, mech., elec.) \$280,000. Client, City of Sullivan, Illinois.

**Sexton & Renwick**  
Ottawa, Illinois  
¶ Interceptor sanitary sewers. (civil) \$321,000. Client, Spring Valley, Illinois.

## INDIANA

**J. B. Wilson & Associates**  
Indianapolis, Indiana  
¶ Water supply, Washington, Ind. (civil, struc., mech., elec.) Client, Graham Farms, Inc.  
¶ Sewers and sewage treatment plant, Zionsville, Indiana. (civil, struc., mech.,



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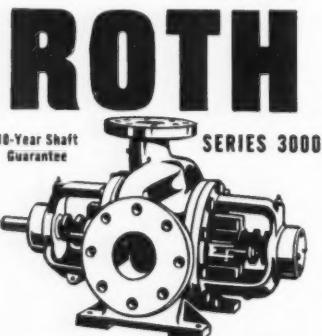
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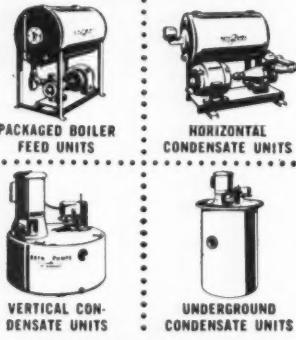


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(elec.) \$350,000. Client, Town of Zionsville, Indiana.

¶ Water supply, distribution, and storage, Liberty, Indiana. (civil, struc., mech., elec.)

¶ Sewers and lagoon, Bloomfield, Indiana. (civil, struc., mech., elec.) Client, City of Bloomfield, Indiana.

¶ Sewers and sewage treatment plant, Sullivan, Indiana. (civil, struc., mech., elec.) \$1.3 million. Client, City of Sullivan, Indiana.

¶ Sewage treatment plant, Hobart, Indiana. (civil, struc., mech., elec.) \$100,000. Client, Ridge Road Investment Corp.

¶ Water supply, distribution, and storage for towns of Bruceville, Cumberland, Edwardsport, and Carthage, Ind. (civil, struc., mech., elec.) Clients, towns,

(mech., elec.) Building cost, \$5 million; mechanical-electrical, \$2 million. Client, Bruck & Johnson, architects.

¶ Music-chapel building, Pikeville Junior College, Pikeville, Kentucky. (mech., elec.) Building cost, \$750,000; mechanical-electrical, \$275,000. Client, Norman Chrisman, Jr., architect.

## MASSACHUSETTS

### Joseph L. Paley

Boston, Massachusetts

¶ Construction of 5000 feet of runway, parallel taxiway, lighting, and relocation of road. (civil, elec.) \$1 million. Client, City of Lawrence Municipal Airport Commission, Lawrence, Mass.

## MICHIGAN

### Stuart D. Long

Grand Rapids, Michigan

¶ New building for Cascade Country Club consisting of bath house, recreation room, heater room, locker rooms for mothers and children, heated swimming and wading pools, and promenade deck for sunning and other outdoor activities. One-story brick building, 2800 sq ft. (mech., elec.) \$50,000. Client, Russell F. Donker & Associates, archs.

¶ First Congregational Church, Traverse City, 30,500 sq ft including auditorium, fellowship hall with kitchen and chapel on main level; lower level consists of classrooms and boiler room. Nave, chapel, and fellowship hall have ventilation units; balance of building is heated by fin tube on hot water. Under floor supply and return air ducts. (mech.) \$350,000. Client, Gordon Cornwell, arch.

## IOWA

### Moore & Bouse

Cedar Rapids, Iowa

¶ Library addition, State University of Iowa. (mech., elec.) \$830,000. Client, Parish & Richardson, architects.

## KANSAS

### K. E. Rector & Associates

Topeka, Kansas

¶ Paving and storm sewers. (civil) \$123,000. Client, City of Topeka.

¶ Barton County paving, grading, and culverts. (civil) \$443,000. Client, Kansas Highway Commission.

¶ Paving and storm sewers. (civil) \$86,000. Client, City of Topeka.

¶ Montgomery County grading and culverts. (civil) \$280,000. Client, Kansas Highway Commission.

¶ Storm sewer Project No. 21. (civil) \$50,000. Client, City of Topeka.

¶ Osage County grading and culverts. (civil) \$90,000. Client, Osage County.

## KENTUCKY

### D. L. Thomas, Civil Engineer

Louisville, Kentucky

¶ Confederate Acres, 594-lot subdivision, roads, drainage, sewers, and treatment plant. (struc., civil) \$1,780,000. Client, Allen Developers.

### Stages & Fisher

Lexington, Kentucky

¶ New elementary school, Lexington, Kentucky. (mech., elec.) Building cost, \$600,000; mechanical-electrical, \$180,000. Client, Brock & Johnson, architects.

¶ Mens dormitory, Eastern State College, Richmond, Kentucky. (mech., elec.) Building cost, \$600,000; mech.-elec., \$180,000. Client, Brock & Johnson, arch.

¶ University of Kentucky chemistry-physics building, Lexington, Kentucky.

## MINNESOTA

### Titleded Corporation

New York, New York

¶ 240 ton per day contact type sulfuric acid plant for North Star Chemicals, Inc. at Pine Bend, Minnesota. (struc., mech., elec., chem.) \$1 million. Client, Quamco, Inc.

### Schoell and Madson

Minneapolis, Minnesota and

Huron, South Dakota

¶ Deep well and pump, Mantorville, Minnesota. (civil) \$6900. Client, Village of Mantorville, Minnesota.

¶ Deep well, pump house, and water distribution system, Winnetka Park, Crystal, Minnesota. (civil) \$75,000. Client, Associated Homes, Inc.

¶ Sanitary sewer collection system, Winnetka Park, Crystal, Minnesota. (civil) \$60,000. Client, Associated Homes, Inc.

## MISSISSIPPI

### Robert A. Scott

Corinth, Mississippi

¶ Complete city-wide sewerage collection and treatment system. (civil) \$150,000. Client, Town of Belmont, Miss.

¶ Feasibility report — water system extension and improvements to present

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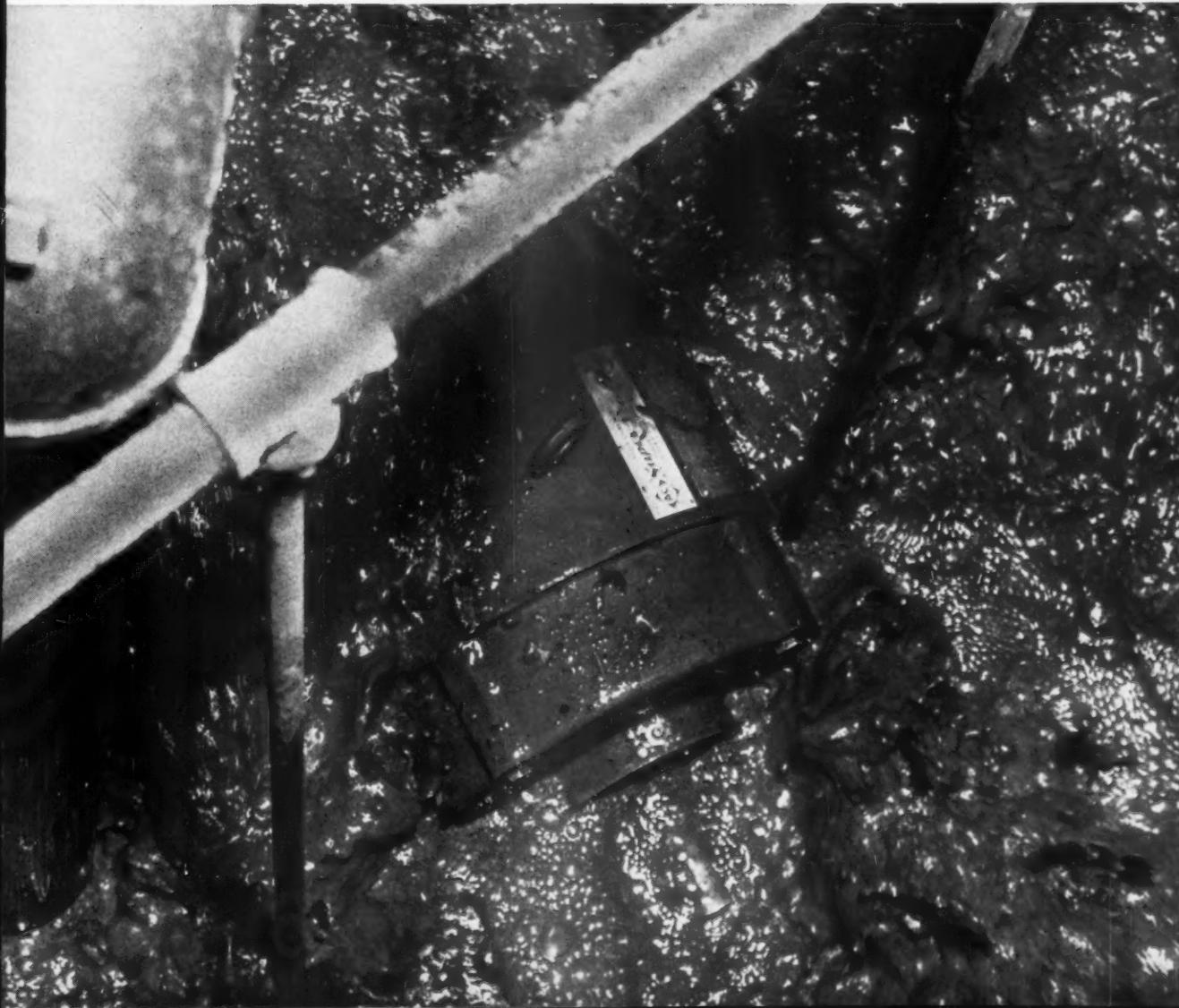
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sewerage treatment plant. (civil) \$90,000. Client, Town of Luka, Miss.

## MISSOURI

Burton A. Tibbits, Consulting Engineer Springfield, Missouri

¶ Ten-story reinforced concrete and masonry addition to existing Woodruff Building, Springfield, Missouri. (struc., civil) \$250,000. Client, Joe W. Amspacher, architect.

¶ Complete plans for packing and meat processing plant, Springfield, Missouri. Structural steel and masonry walls with prestressed roof slabs. Plans include all equipment, refrigeration, and mechanical work. (struc., civil, mech., elec.) \$100,000. Client, Queen City Packing.

¶ Plans for complete concrete block plant with possible provisions for manufacture of concrete pipe, Springfield, Missouri. Plans to include all construction and equipment layout. (struc., civil, mech., elec.) Client, DeWitt-Newton, Inc.

## MONTANA

R. L. Prussing Engineers Billings, Montana

¶ Deaconess Hospital addition. (mech.) \$300,000. Client, architect.

¶ Eastern Montana College of Education field house. (mech.) \$350,000. Client, architect.

¶ Lander high school addition. (mech.) \$240,000. Client, architect.

¶ Hamilton Stores warehouse, West Yellowstone. (mech.) \$30,000. Client, owner.

¶ MST&T Company dial exchange building addition. (mech.) \$150,000. Client, architect.

¶ Clinic building, Glasgow, Montana. (mech.) \$25,000. Client, architect.

¶ Office building, Billings, Montana. (mech.) \$300,000. Client, architect.

¶ Latter Day Saints church, Billings, Mont. (mech.) \$65,000. Client, arch.

## NEW JERSEY

John J. Barabas, Electrical Engineer Trenton, New Jersey

¶ Hub City office and warehouse, Trenton, New Jersey. (elec.) \$115,300. Client, W. H. Neubeck, architect.

¶ St. Leo The Great Roman Catholic school-church combination, Lincroft, New Jersey. (elec.) \$548,000. Client, T. H. Moran, architect.

¶ Trenton Catholic Welfare Center, Trenton, N.J. (elec.) \$145,000. Client, T. H. Moran, architect.

¶ St. James Roman Catholic Church, Trenton, N.J. (elec.) \$375,000. Client, T. H. Moran, architect.

## NEW MEXICO

J. L. Breese & Associates

Santa Fe, New Mexico

¶ Maxwell high school, Maxwell, New Mexico. Heating and plumbing. (mech.) \$100,000. Client, James A. Buran, arch.

¶ 7-Up Bottling plant, Albuquerque, New Mexico. Heating, air conditioning.

and plumbing. (mech.) \$200,000. Client, Stanley & Wright, architects.

¶ Office building for Dr. Merl Yordy, Espanola, New Mexico. Heating, air conditioning and plumbing. (mech.) \$75,000. Client, Allan McKown, arch.

¶ Miscellaneous residences, Santa Fe and Los Alamos, New Mexico. Heating and plumbing. (mech.) \$150,000. Clients, R. E. Plettenberg, architect and Louis Walker, architect.

## NEW YORK

Stuart H. Snyder

Syracuse, New York

¶ F. Ware Clary junior high school, Syracuse, New York. Steel frame includes cantilevered system over classrooms, rigid frames in gym, and truss framing over auditorium. (struc.) \$2.3 million. Client, Pederson, Hueber, Hares & Glavin, architects.

¶ Maine-Endwell senior high school, Maine, New York. Steel framed structure with 3-story classroom wing, auditorium and gym. (struc.) \$3 million. Client, Walter Paul Bowen, architect.

¶ St. Cyril's Roman Catholic church, Binghamton, New York. Steel and concrete structure with masonry arches and space-frame tower. (struc.) \$750,000. Client, Walter Paul Bowen, architect.

¶ Cayuga county jail, Auburn, New York. New four-story concrete flat-plate building. (struc.) \$500,000. Client, Robert S. Richards, architect.

¶ Five-story addition to St. Joseph's Hospital, Syracuse, New York. Steel framed complex structure partially cantilevered. (struc.) \$500,000. Client, Pederson, Hueber, Hares & Glavin, arch.

Charles M. Shapiro, P.E.

Brooklyn, New York

¶ Building extension for warehousing and shipping, Queens, N.Y. (struc., civil, mech.) \$45,000. Client, Hormas Corp.

¶ Replace existing elevator with larger freight elevator and shaft, Brooklyn, New York. (struc.) \$35,000. Client, United Metal Goods Mfg. Corp.

¶ One-story fireproof factory, 3500 sq ft, sprinklered, Queens, New York. (struc., civil, mech.) \$25,000. Client, Park Nameplate Co., Inc.

## NORTH DAKOTA

Schoell and Madson

Minneapolis, Minnesota and

Huron, South Dakota

¶ Planning, drainage, sanitary sewers, and water distribution system, Country Club Manor, Minot, North Dakota. (civil) \$600,000 (est.) Client, Rogers Construction Company.

## OHIO

Willard F. Schade & Associates

Cleveland, Ohio

¶ Sewage treatment plant. (struc., civil, mech., elec.) \$350,000. Client, Trumbull County, Ohio.

¶ Sewage treatment plant, Rocky River,

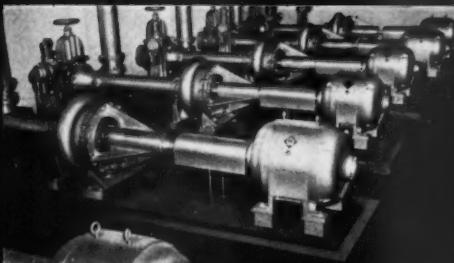
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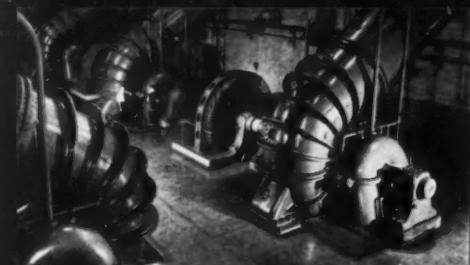
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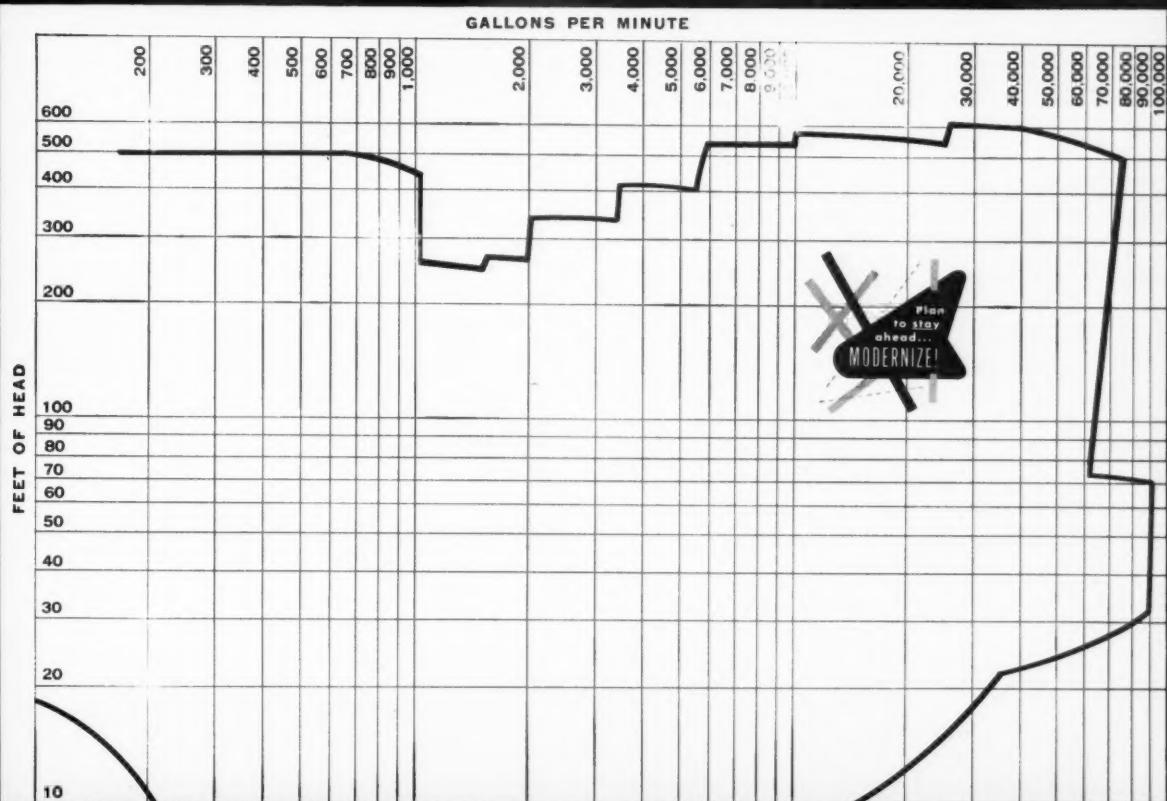
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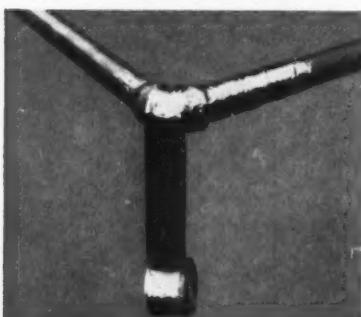
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Pittsburgh, Pennsylvania

¶ Lloyd F. Rumbaugh elementary school. (struc., civil) \$225,000. Client, Joseph Hoover, architect.

¶ McCullough Electric Co. building addition, complete modernization, structural steel, steel joists, concrete floor, masonry work, elevators, store fronts. (struc.) \$75,000. Client, C. F. Slater, arch. ¶ Bowling alley, Italian Citizens Club, Monongahela, Pa. (struc., civil) \$100,000. Client, D. Trnaysky, architect.

¶ St. Edward's Church, Fayette City, Pa. Repairs to church due to soft cement and new structural supports. (civil, struc.) \$25,000. Client, H. Clark, arch.

**David R. Witte**

Philadelphia, Pennsylvania

¶ Warehouse, 40,000 sq ft. (civil, struc., mech., elec.) \$250,000. Client, Standard Transportation Co.

**Ebert & Park**

Pittsburgh, Pennsylvania

¶ Library, California State Teachers College, California, Pennsylvania. (mech.) \$550,000. Client, C. G. Dickson, arch. ¶ Office building, Pittsburgh Pipe & Coupling Co., Allison Park, Pennsylvania. (mech.) \$300,000. Client, T. C. Pratt & Associates, architects.

¶ Commercial building, J. C. Penney Co., Uniontown, Pennsylvania. (mech.) \$300,000. Client, Altman & Altman, arch.

**A. W. Martin Associates**

King of Prussia, Pennsylvania

¶ King of Prussia Industrial Park. (civil) \$60 million. Client, Cabot, Cabot & Forbes, Boston, Mass.

¶ Sanitary sewerage system. (civil) \$3 million. Client, Upper Merion Township, King of Prussia, Pa.

¶ Limited access highway. (struc., civil) \$1 million. Client, Upper Merion Township, King of Prussia, Pa.

¶ 500-unit housing development. (struc., civil) \$7.5 million. Client, Springview Corp., Upper Darby, Pa.

**SOUTH CAROLINA**

**The Harwood Beebe Company**

Spartanburg, South Carolina

¶ Municipal sewers and sewerage system improvements. (civil) \$4 million. Client, City of Anderson, South Carolina.

**SOUTH DAKOTA**

**Schoell and Madson**

Minneapolis, Minn. and Huron, S.D.

¶ 26,000 feet of 12- and 8-in. water transmission main. (civil) \$172,840. Client, City of Huron, South Dakota.

¶ Three million gal. reinforced concrete ground storage water tank, pumping station, pump controls, and piping. Joint venture with Frey & Bergsten, electrical and mechanical engineers, Minneapolis. (struc., civil, mech., elec.) \$180,000. Client, City of Huron, S. D. ▲▲

Ohio. (struc., civil, mech., elec.) \$3 million. Client, Cuyahoga County, Ohio.  
 ¶ Sewer. (civil) \$100,000. Client, Canfield, Ohio.  
 ¶ Sewage treatment plant. (civil) \$30,000. Client, Berea, Ohio.  
 ¶ Sewage treatment plant. (struc., civil, mech., elec.) \$500,000. Client, Solon, Ohio.  
 ¶ Sewers. (civil) \$1 million. Client, Solon, Ohio.  
 ¶ Sewers. (civil) \$350,000. Client, Trumbull County, Ohio.

**Floyd G. Browne & Associates**

Marion, Ohio

¶ Storm sewer system study. (civil) Client, Alliance, Ohio.  
 ¶ Sewerage system. (civil) Client, North Canton, Ohio.  
 ¶ Sewer design. (civil) Client, Stark County, Ohio.  
 ¶ Water system study. (civil) Client, Limestone Valley Sewer District, Muskingum County, Ohio.  
 ¶ Sanitary sewerage system. (civil) Client, Mineral Ridge Sewer District, Trumbull County, Ohio.  
 ¶ Sanitary sewerage system. (civil) Client, Magnolia, Ohio.  
 ¶ Sanitary sewerage system. (civil) Client, Middleport, Ohio.

**The H. C. Nutting Company**

Cincinnati, Ohio

¶ Millcreek expressway, Cincinnati, Ohio. (civil) Client, Cincinnati, Ohio.  
 ¶ Northwest expressway, Hamilton County, Ohio. (civil) Client, Ohio.  
 ¶ Dillon Woods reservoir road relocation. (civil) Client, Corps of Engineers.

**G. E. Villena, Engineers**

Cincinnati, Ohio

¶ Hamilton County patrol and communications building. (struc.) \$250,000. Client, Hamilton County, Ohio.

**OKLAHOMA**

**John C. Pennefeather**

Tulsa, Oklahoma

¶ Hillcrest Medical Center. Air conditioning of existing older buildings for the hospital. High pressure induction units plus fan coil units with ductwork — 300 tons on air side with 150 tons new capacity, and 150 tons taken from existing chilled water system. (mech., elec.) \$260,000. Client, Hillcrest Medical Center, Hugh R. Humphreys, arch.

**L. M. McGoodwin, Consulting Engineer**

Fayetteville, Arkansas

¶ Waterworks improvements, water mains, and water treatment plant, Sallisaw, Oklahoma. \$300,000. (est.)

**OREGON**

**Thomas E. Taylor**

Portland, Oregon

¶ Heating plant revisions and steam distribution system for state capitol mall, Salem, Oregon. (mech.) \$235,000. Client, State of Oregon.

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oilless units**

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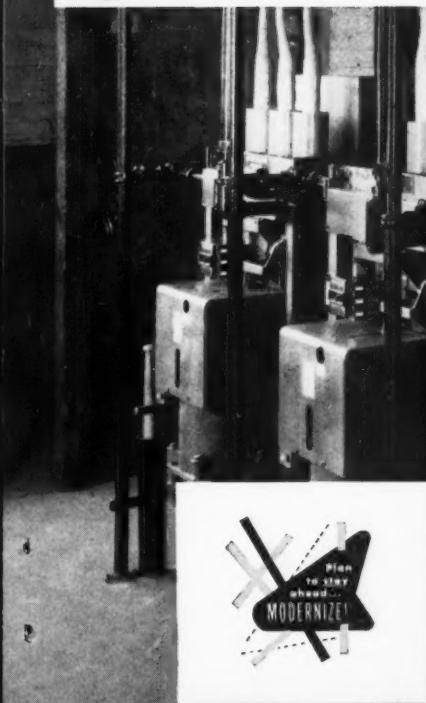
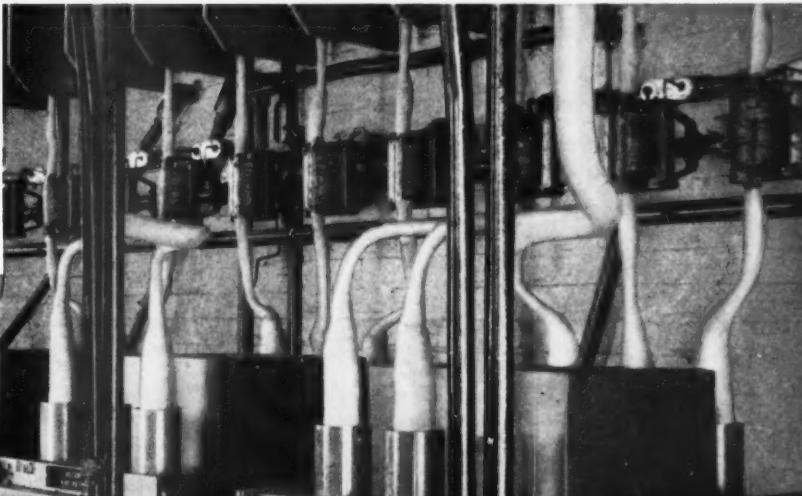
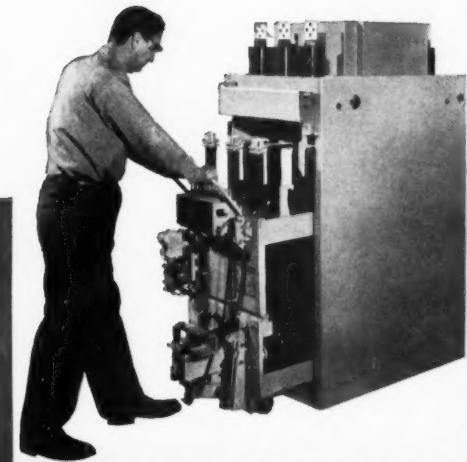
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adapt it to a  
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Take a good look at this hopper scale. It has many practical features for almost any weighing application.

Take the upper and lower frames. They are designed to accommodate many standardized feed and discharge components: sliding gates, vibratory feeders, screw feeders and others. These units are pre-engineered; their performance has been fully proven in use. Costs are, therefore, correspondingly lower. Satisfactory operation is confirmed in advance.

Now look at the middle or hopper frame. Note the flexure mountings. They give stability to the unit and deliver a single component of force to the weight transmitter regardless of load distribution. The transmitter, itself, may be either electric or pneumatic; the signal can be used for weight indication, recording, automatic batching.

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# Consulting Engineers' Calendar

Conference, Lord Baltimore Hotel, Baltimore, Maryland.

Oct. 11-16. American Institute of Electrical Engineers; Fall General Meeting, Morrison Hotel, Chicago, Illinois.

Oct. 19-23. American Society of Civil Engineers; Annual Convention, Hotel Statler, Washington, D. C.

Oct. 20. American Institute of Consulting Engineers; Annual Dinner, Mayflower Hotel, Washington, D. C.

Oct. 20-22. American Standards Association; 10th National Conference on Standards, Sheraton-Cadillac Hotel, Detroit, Michigan.

Oct. 26-28. American Road Builders' Association; National Highway Conference, Leamington Hotel, Minneapolis, Minnesota.

Oct. 27. Association of Consulting Chemists and Chemical Engineers, Inc.; Annual symposium and banquet, Hotel Shelburne, New York, N. Y.

Nov. 3-5. American Concrete Institute; Regional Meeting, Continental Hilton Hotel and Hotel Del Prado, Mexico City, Mexico.

Nov. 4. American Institute of Consulting Engineers; Luncheon Meeting, Engineers Club, New York, N. Y.

Nov. 16-19. American Institute of Electrical Engineers; Fifth Conference on Magnetism and Magnetic Materials; Sheraton-Cadillac Hotel, Detroit, Michigan.

Nov. 30-Dec. 4. 27th Exposition of Chemical Industries, New York Coliseum, New York, N. Y.

# NEW oil-immersed line...

Now, from Allis-Chalmers, comes the most complete line of motor control ever developed. With the addition of an all-new line of oil-immersed controllers and contactors, you can select just the right control — oil or air — to meet your needs. Ratings are to 1500 hp at 2200 volts; 2500 hp at 4000-5000 volts.

**For divisions 1 and 2** (hazardous and semi-hazardous locations) or corrosive atmospheres: A-C offers 400-ampere, 50-mva oil-immersed controllers with floor-mounted lift-out or frame-mounted tank-lowering construction. Load-break disconnect switches optional.

**Type H front access controllers** with current-limiting fuses are available where higher interrupting capacities are required. Type H units are available with oil-immersed contactors for semi-hazardous areas and other applications; air-break contactors for non-hazardous areas.

Type H controllers can be specified with *Shelter-Clad* walk-in, outdoor enclosure for complete protection of personnel and equipment. With this simple, all-steel design you can eliminate expensive, permanent buildings.

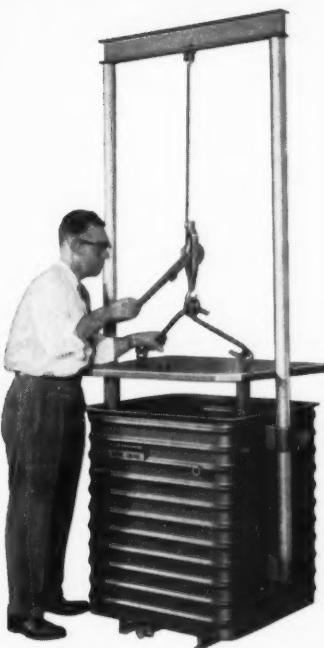
**For full details** on the complete line of A-C motor control, either high or low voltage, contact the A-C office near you, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

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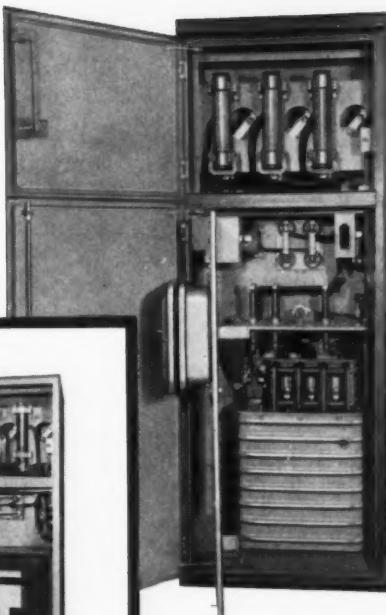
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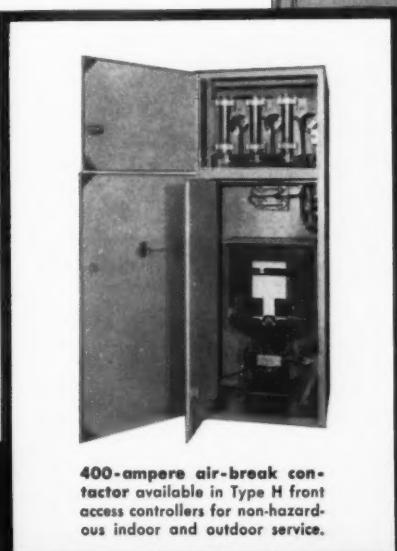
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**Oil-immersed controller** is equipped with portable lifter for simplified access to lift-out contactor and relay panels.



**400-ampere oil-immersed contactor** available in Type H front access controllers for indoor, outdoor, or Division 2 service.



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Marlo offers a complete line of equipment for every air conditioning and heat transfer need. Consult the Marlo representative in your area, or write direct to us for further information.

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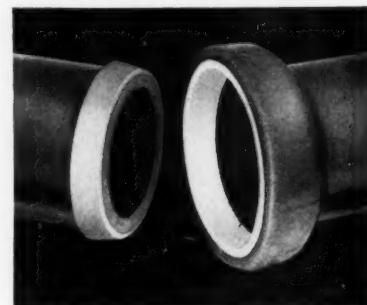
Thus, infiltration, exfiltration, and root penetration are prevented.

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The joint is on the pipe delivered to the job site ready for immediate installations. No other materials such as caulking, joint compound, hot pots, or ladles are needed to make the Amvit Joint.

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Amvit is made from a plastic which has many characteristics similar to rubber. It is pliable, permitting deflec-



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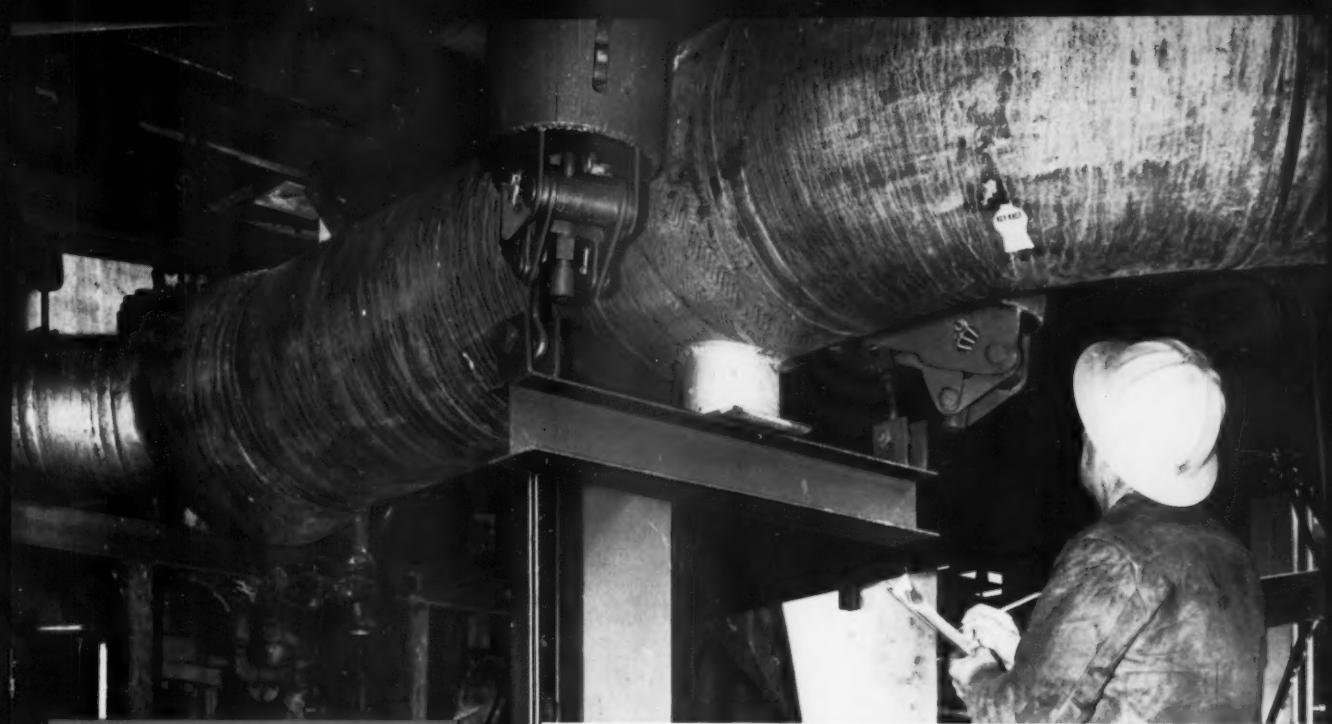
For more information on how Amvit can help cut your sewer installation costs, write or call American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you, for this descriptive folder.



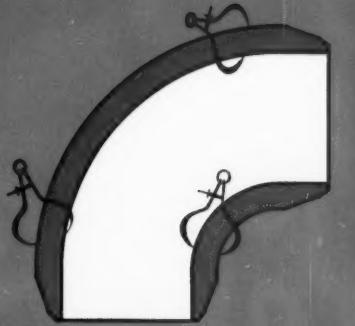
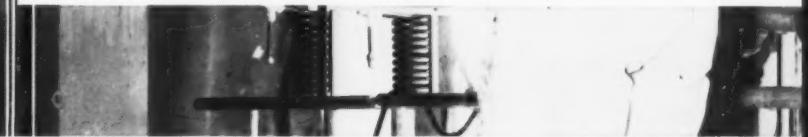
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Key-Kast 27 1/2" elbow and wye fittings at Houston Lighting & Power Company's new Sam Bertron Power Station near the Houston Ship Channel. Designer: Ebasco Services, Inc. Engineers and Contractors: Benjamin F. Shaw Company.



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Key-Kast Elbows have uniform cast steel walls approximately 15% heavier than the required minimum thickness of pipe walls of the same I.D. For extra highly stressed line sections, the wall thickness can be increased as much as desired — without sacrificing uniformity.

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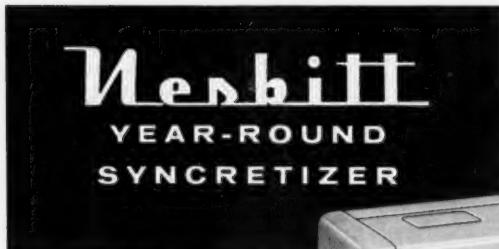
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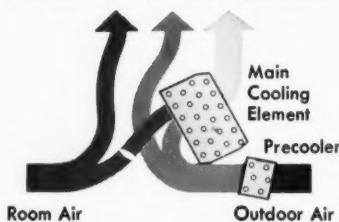
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You'll get outstanding service



# Newest Advance in classroom air conditioning



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The exclusive Nesbitt Precooler combined with bypass control assures precise temperature and humidity control for each classroom every day of the year.

As illustrated, the Precooler (a second cooling element) prevents hot, humid outdoor air from entering the classroom without first being precooled and dehumidified. This Precooler adds 15% to 30% free cooling capacity—actually it is capable of *wringing* one-half gallon of moisture from outdoor air on hot, humid days.

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The Nesbitt Year-Round Syncretizer has been designed specifically to meet the performance, safety and budget requirements of schools and colleges for year-round air conditioning. For instance, summer and winter, control of heating, cooling, ventilating and dehumidifying is completely automatic—accomplished quietly, economically.

Operating economies are achieved in mild weather when natural cooling with 100% outdoor air permits hundreds of hours of operation without running refrigeration equipment. Power costs are lower too—the Year-Round Syncretizer moves more air per watt of power consumed than any other unit or system.

Space can be conditioned selectively. Only as much or as little of the building as meets the need can be equipped for air conditioning—and only the space actually in use need be conditioned.

Want to know more about this new advance in classroom air conditioning from Nesbitt? Write for Publication 11-2.

## Nesbitt

**Heating, Ventilating and  
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